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MIL-HDBK-61

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MILITARY HANDBOOK

CONFIGURATION MANAGEMENT GUIDANCE

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FOREWORD

1. This military handbook is approved for use by all Departments and Agencies of the Department of Defense.

2. This handbook provides guidance to DoD managers assigned the responsibility for configuration management on how to ensure the application of product and data configuration management to defense materiel items, in each phase of their life cycle, during a period of significant change in acquisition practices. The manner in which CM is specified in a contract and the process of monitoring contractor application are evolving as the result of two interacting transitions.

3. The first transition is the change in acquisition approach brought about by acquisition reforms introduced via the June 1994 directed implementation of the recommendations contained in the *Blueprint for Change* Report of the DoD Process Action Team on Military Specifications and Standards. It has resulted in the following conceptual changes:

a. A shift from the Government imposing requirements on a contractor by citing a military standard to the Government asking the contractor how he intends to apply his standard management practices to a given program and evaluating those practices against industry standards.

b. Limiting the focus of Government configuration control to performance requirements rather than the details of the design solution in most instances.

c. Basing Government oversight of contractor practice on adequacy of process rather than on inspection of product .

4. The second significant transition influencing configuration management practice results from the rapid advance of information technology. Opportunities for improvements in methodology are constantly challenging the status quo. The predominant media for exchange of information is in transition from a paper base to a digital one. CALS concepts and standards for information management, data transfer, and sharing are increasing the opportunities for Government and industry to productively integrate information from distributed data bases. The Government is defining a standard infrastructure that will contain the configuration management information necessary for the life cycle support and maintenance of its equipment and software. Both Government activities and contractors will be able to access and/or input product information directly to the DoD Configuration Management Automated Information System (CM AIS).

5. Beneficial comments (recommendations, additions, deletions) and other pertinent data which may be of use in improving this document should be addressed to: Linda Fowble, Policy and Planning Division, CALS and Electronic Data Interchange Office, 5203 Leesburg Pike, Suite 1609, Falls Church, Va 22041-3466, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document, by letter, or by e-mail to fowblels@ acq.osd.mil.

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SECTION 1
INTRODUCTION

QUESTIONS THIS SECTION WILL ANSWER:		PARA.
1.	What are the scope and purpose of this handbook? Who should use it?	1.1
2.	To what other documents does this handbook relate, and what is the nature of the relationship?	1.1
3.	How does the user locate specific information related to each life cycle phase and CM function?	1.2
4.	What is configuration management?	1.3
5.	What is the Government's role in the CM process; what is a contractor's role; and how do they relate?	1.3.1
6.	How does CM impact program costs?	1.3.2
7.	What are the benefits of having effective CM on a DoD program?	1.3.2
8.	What risks are associated with the lack of CM, or ineffectual CM?	1.3.2
9.	What are the basic CM definitions used in this handbook? What is the "correct" CM terminology to use on a DoD program/project?	1.4

1.1 Scope and Purpose.

This military handbook provides guidance and information to DoD acquisition managers, logistics managers, and other individuals assigned responsibility for Configuration Management. Its purpose is to assist them in planning for and implementing effective DoD configuration management activities and practices during all life cycle phases of defense systems and configuration items. It supports acquisition based on performance specifications, and the use of industry standards and methods to the greatest practicable extent. MIL-STD-973, which previously governed DoD configuration management procedures, is being phased out.

This handbook is closely related to **MIL-STD-2549**, "Configuration Management Data Interface," the **Electronic Industries Association (EIA) Standard 649**, "National Consensus Standard for Configuration Management," and **EIA Standard 632**, "Processes for Engineering a System."

MIL-STD-2549 details the Government interface requirements for the exchange of CM information in CM databases. It enables both commercial and Government development of compatible database management tools that will allow the DoD to manage its product information and will allow Government and industry activities to electronically share that data. It defines the logical content and the relationships of the information that should exist as the information transfers from one activity (and management tool) to another, that is, the business rules view. (**NOTE:** A DoD Configuration Management Automated Information System (CM AIS) database tool is being developed in accordance with these business rules for DOD activities who have no other tool available; it includes a change document authoring and routing tool and will be accessible to any user or industry partner.)

EIA Standard 649 provides the basic configuration management principles and the best practices employed by industry to identify product configuration and effect orderly management of product change. In basing its source selection on past and current performance, the Government expects its preferred suppliers to employ robust internal configuration management processes that embody those basic principles.

EIA Standard 632 describes the Systems Engineering process of which CM is an integral part. **[See 2.2.2]**

The acquisition reform environment is significantly different from one in which the Government imposed its own management requirements on contractors by military standards. Configuration management activity must be applied to items at a level which is consistent with acquisition strategy, protects the interests of the government, and flexibly accommodates contractor standard methodology. With a major share of configuration control authority

shifted to contractors, the DoD configuration management activity must still continue to provide assurance of supportability and interoperability of military equipment and software. This responsibility requires careful planning and implementation of a DoD configuration management strategy that is in concert with the acquisition, logistic support, and maintenance philosophy of each given material item.

As the DoD transitions to performance based acquisition and the use of the new standard interface for CM information, this handbook provides the insight necessary to:

- Understand the application of the basic principles of CM articulated in EIA-649 to the DoD acquisition and operational environment
- Plan for and make prudent and cost effective choices in effecting DoD configuration management activities throughout the life cycle of a material item
- Provide the necessary basis for CM in RFPs and Contracts
- Evaluate contractor proposals and CM processes
- Acquire and process necessary CM information
- Use the data model and data dictionary in **MIL-STD-2549** as the common framework for communicating configuration information among diverse, distributed, data bases (facilitating a transition to an integrated data environment)
- Measure CM performance effectiveness of both Government activities and contractors

1.2 Application of CM over the Program Life Cycle Phases

Figure 1-1 illustrates how this military handbook's content is structured to provide a comprehensive guide (roadmap) to the application of configuration management through all life cycle phases of a program. As defined in **DoD 5000.2-R,** the life cycle extends from concept studies through demilitarization and disposal. A given military program, however may not include all of the phases. The handbook is divided into the following sections:

a. Section 2. CM Life Cycle Management and Planning. Since management and planning are the keys to effective implementation of CM, Section 2 provides the focus for the entire handbook. It contains an overview of the CM process, a discussion of CM's relationships to other processes, and a synopsis of Government/contractor configuration management during the entire program life cycle. It addresses global CM Management activities applicable to all phases such as planning, process implementation, and performance measurement. A series of templates **[Tables 2-1 through 2-4]** address the following for each life cycle phase:

- CM Objectives keyed to the program objectives for the Phase **[Figure 2-5]**
- CM Activities supporting those objectives
- Benefits and risks
- Metrics to assess achievement of objectives and foster process improvement
- Key actions to be taken, interfaces to be established and information needed to perform the activities
- Pointers and references to specific supporting details found in Sections 2 through 7 and Appendices.

b. Sections 3 through 7. Major CM Functions. In support of Section 2, Sections 3 through 7 contain detailed information in the form of activity descriptions, activity models, principles and concepts, and activity guides (diagrams, checklists, tables, etc.) for the following topics:

- Section 3 Configuration Identification
- Section 4 Configuration Control
- Section 5 Configuration Status Accounting
- Section 6. Configuration Verification and Audit
- Section 7. Data Management

c. Appendices. The appendices to this handbook consist of additional information, supporting either the planning and information timeline in Section 2 or the details in Sections 3 through 7.

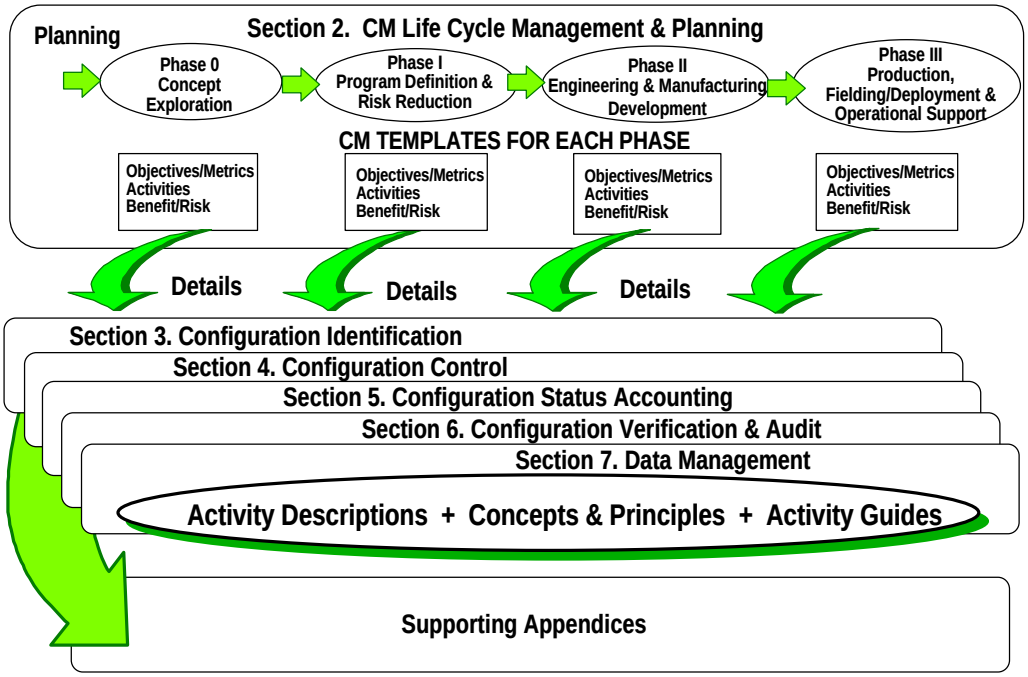


Figure 1-1. MIL-HDBK-61 Provides a Roadmap to the Application of CM in each Phase of the Life Cycle

1.3 Configuration Management Overview.

Configuration management embodies two concepts: (1) the configuration management of items and their defining technical data, referred to herein as configuration documentation; and (2) the application of CM principles to digital data in general. **[Section 7]** Because, digital data management is critical to the control of configuration documentation and therefore to the configuration management of Weapon Systems, document management rules are integral to the CM process.

Configuration management is defined[1] as a process for establishing and maintaining consistency of a product's performance, functional and physical attributes with its requirements, design and operational information throughout its life. **Figure 1-2** is a top-level activity model depicting the CM process showing:

- Inputs - Information needed to initiate and perform the process
- Constraints - Factors or information that inhibits or puts limitations on the process
- Mechanisms/Facilitators - Information, tools, methods, and technologies which enable or enhance the process
- Outputs - Results that derive from the process or information that is provided by the process.

NOTE: Activity models in this handbook follow the above format, which is a simplification of the IDEF0 (Activity Model) protocol.

DoD Regulation 5000.2-R states the requirement for:

"..... a configuration management process to control the system products, processes and related documentation. The configuration management effort includes identifying, documenting and verifying the functional and physical characteristics of an item; recording the configuration of an item; and controlling changes to an item and its documentation. It shall provide a complete audit trail of decisions and design modifications."

[1] EIA-649

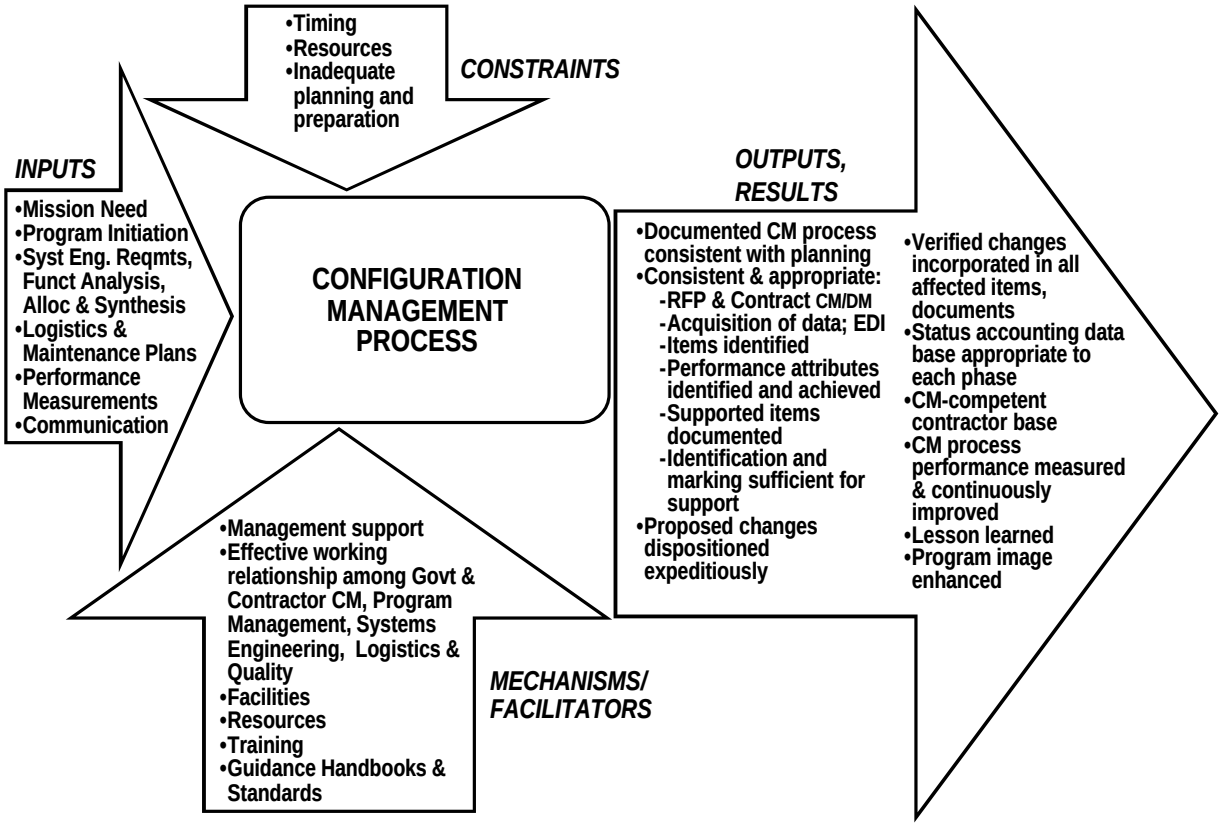


Figure 1-2. DoD Configuration Management Process Model - Overview

The CM process encompasses:

- Configuration items
- Documents that define the performance, functional, and physical attributes of an item. These documents are referred to as configuration documentation.
- Other documents which are used for training, operation and maintenance of an item
- Associated and interfacing items that are used for training, operation, or maintenance of the configuration item.

The CM process is embodied in rules, procedures, techniques, methodology and resources to assure that:

- The configuration of the system and/or item (its attributes) are documented. **[Section 3]**
- Changes made to the item in the course of development, production and operation, are beneficial and are effected without adverse consequences. **[Section 4]**
- Changes are managed until incorporated in all items affected. **[Sections 4, 5 and 6]**

CM is applied to defense material, whether hardware or software, that are designated as "systems" and "configuration items." Systems generally refer to the level at which major defense acquisitions are defined and managed. A configuration item (CI) may be an individual item, or may be a significant part of a system or of a higher level CI. It is designated at an appropriate level for documenting performance attributes and managing changes to those attributes The concept of CIs has confused some people into thinking that the level at which they are designated is the point at which configuration management stops. In reality, the CI level is where configuration management really begins; the process encompasses, to some degree, every item of hardware and software down to the lowest bolt, nut and screw, or lowest software unit. This does not mean that the acquiring activity, the prime contractor, or even subcontractors have visibility or configuration control authority over every part. Rather it means that some organization within either the supply chain or the standardization process has configuration documentation and change control responsibility for each part.

The attributes of configuration items are defined in configuration documentation. Configuration baselines are established to identify the current approved documents. Configuration items are uniquely identified. They are verified to make sure they conform to, and perform as defined in, the configuration documentation.

Whenever a change is contemplated to an item, the effect of that change on other items and associated documents is evaluated. Changes are systematically processed and are approved by the appropriate change control authority. Change implementation involves update and verification of all affected items and documentation.

Information about item configuration, document identification and status, and change status is collected as activities associated with the CM process occur. This configuration status accounting information is correlated, maintained, and provided in useable form, as required.

The responsibility for the CM process and supporting activities is shared between the Government and the contractor and will usually vary according to the acquisition philosophy (performance or design-based) and according to the phase of the life cycle.

1.3.1 Government and Contractor Roles in the CM Process.

Both the Government and the contractor participate in the CM process. However, depending on the agencies involved in a particular "contracting " arrangement, there are several other terms that may also be used. (See the list below.) In the context of this handbook, a Government activity engaged in design, development or production of hardware or software items is considered to be a "contractor."

	Alias Terms Used in:	
Term Used in MIL-HDBK-61	**Government to Commercial Environment**	**Government to Government Environment**
Contractor	• Contractor • Design Activity • Performing Activity	• Design Activity • Performing Activity
Government	• Government • Managing Activity • Tasking Activity	• Managing Activity • Tasking Activity
Contract	• Contract • Purchase Order	• Tasking Directive • Memo of Agreement • Military Interdepartmental Purchase Request (MIPR)

Since, the Government has ultimate responsibility for the performance and configuration of the systems and equipment it acquires and operates, the Government is always the configuration control authority for the top-level performance attributes, and for selected lower level performance and design attributes that it specifies and contracts for. A significant degree of authority for configuration control may be exercised by contractors during any or all phases of the life cycle, depending on such factors as type of acquisition, contractual requirements, and ownership of the data.

For a specific acquisition, configuration control authority means that the activity or organization exercising that authority controls the configuration of the product and determines what changes are to be installed or incorporated in that product.

It does not mean that the Government or any other configuration control authority can unilaterally authorize change to configuration documentation throughout the life cycle. Each configuration document has a current

document change authority (CDCA), i.e. an agency or activity or organizational entity that is responsible for the content of the document and is the only authority that can effect changes to the document.

The concept of current document control authority (CDCA), introduced in **MIL-STD-2549,** establishes that configuration control authority to effect a product configuration change under a contract does not automatically mean that a change can be directed or made to a document for which another organization is the controlling design activity and has content responsibility. An activity that uses a product and its documentation, but is not the CDCA, is referred to as an Application Activity (AA). An AA can only approve for use (adopt) the document, but cannot direct changes to it. These concepts become increasingly more important as DoD acquisition looks to the commercial industrial base, and it is central to the management of an automated information system concerning documentation used by different application activities. **[Details: 4.1.1.1]**

The CM process is applicable both to development of new systems and items and to modifications of existing systems and items. A typical distribution of CM related roles is shown in **Table 1-1**; responsibilities included for continuity that are not primarily configuration management activity are italicized.

Table 1-1. Typical Government and Contractor CM Roles and Responsibilities

Applies to Development of New Systems and to Modifications of Existing Systems	
Government	**Contractor(s) or Government Performing Activities**
• *Solicits concept (Systems Engineering) studies. May participate on Integrated Product Team (IPT)* • *Specifies desired performance attributes for a system/CI* • *Selects Contractor or approves engineering change proposal or modification request* • Approves and baselines top level performance configuration documentation (specifications) and acts as current document control authority (CDCA) for those performance specifications and configuration control authority for the System/CI • Monitors contractor CM process via: - IPT participation - Metrics - Performance reviews • Baselines selected product performance configuration documentation after verifying (e.g. FCA) that performance requirements have been achieved • Continues as CDCA for selected performance configuration documentation; may become CDCA for other documentation as contractually established • Consistent with support approach for selected CIs, baselines selected product (design) configuration documentation after verifying (e.g. at a PCA for the CI) that the design documentation matches the delivered configuration. • Continues as configuration control authority for the System/CI during its life as a Government asset and CDCA for selected performance and design documentation, as contractually established. • Similar cycle repeats for modifications	• *Performs system engineering studies. Determines alternative system approaches* • *Proposes Items or Design Solution* • Prepares and submits performance specification for approval. May participate with Government on IPT. • Initiates development. Incrementally baselines design solution and acts as current document control authority (CDCA) for released configuration documentation, e.g. performance and detail specifications (below the level controlled by the Government), engineering drawings, engineering models, etc. for which another Government activity or commercial organization is not already the CDCA) • Baselines product (design) configuration documentation after verifying performance attributes and consistency between item and configuration documentation. (FCA & PCA) • Continues as CDCA for configuration documentation which it does not transition to the Government • Similar cycle repeats for modifications

1.3.2 CM Benefits, Risks And Cost Impact.

Configuration Management provides knowledge of the correct current configuration of defense assets and the relationship of those assets to associated documents. The CM process efficiently manages necessary changes, ensuring that all impacts to operation and support are addressed.

The benefits of the process should be obvious but are often overlooked. EIA-649 summarizes the benefits of CM from an industry view, as follows:

- Product attributes are defined. *Provides measurable performance parameters. Both Buyer and Seller have a common basis for acquisition and use of the product.*
- Product configuration is documented and a known basis for making changes is established. *Decisions are based on correct, current information. Production repeatability is enhanced.*
- Products are labeled and correlated with their associated requirements, design and product information. *The applicable data (such as for procurement, design or servicing the product) is accessible, avoiding guesswork and trial and error.*
- Proposed changes are identified and evaluated for impact prior to making change decisions. *Downstream surprises are avoided. Cost and schedule savings are realized.*
- Change activity is managed using a defined process. *Costly errors of ad hoc, erratic change management are avoided.*
- Configuration information, captured during the product definition, change management, product build, distribution, operation, and disposal processes [the equivalent of the DoD acquisition life cycle], is organized for retrieval of key information and relationships, as needed. *Timely, accurate information avoids costly delays and product down time; ensures proper replacement and repair; and decreases maintenance costs.*
- Actual product configuration is verified against the required attributes. Incorporation of changes to the product is verified and recorded throughout the product life. *A high level of confidence in the product information is established.*

These benefits are equally applicable to Government and industry. Additionally, the effective application of CM principles to defense products contributes to and enhances the partnering environment desired between the DoD and its suppliers.

In the absence of CM, or where it is ineffectual, there may be equipment failures due to incorrect part installation or replacement; schedule delays and increased cost due to unanticipated changes; operational delays due to mismatches with support assets; maintenance problems, down-time, and increased maintenance cost due to inconsistencies between equipment and its maintenance instructions; and numerous other circumstances which decrease operational effectiveness and add cost . The severest consequence is catastrophic loss of expensive equipment and human life. Of course these failures may be attributed to causes other than poor CM. The point is that the intent of CM is to avoid cost and minimize risk. Those who consider the small investment in the CM process a cost-driver may not be considering the compensating benefits of CM and may be ignoring or underestimating the cost, schedule and technical risk of an inadequate or delayed CM process.

Throughout this handbook, selection criteria are provided to aid in making choices concerning implementation of various CM activities and functions. In each applicable instance, the means to complete a benefit/risk analysis is provided.

1.4 Definitions And Terminology.

Definition of the terms used in this handbook may be found in MIL-STD-2549 (Interface Standard) and in EIA/IS-649. Since a major goal of acquisition streamlining is to use commercial and industry practices to the greatest extent possible, there is no single correct set of CM terminology that must be rigidly adhered to. EIA/IS-649

illustrates many aliases that are commonly used in different industrial environments. It is appropriate to allow the use of terms common (local) to a given industry when dealing with that industry.

When digital data base information is being interchanged, the local terminology is translated to the standard data elements **[MIL-STD-2549, Appendix C]**, so that the standard DoD databases (JEDMICS and CM AIS) can properly interpret it.

SECTION 2
CM LIFE CYCLE MANAGEMENT AND PLANNING

	QUESTIONS THIS SECTION WILL ANSWER:	Para.
1.	What management activities comprise the CM Process; how are they related?	2.2, 2.2.1, 2.2.2, 2.2.3
2.	What Government CM Manager's management activities are part of the process?	2.3, 2.3.1 - 2.3.5
3.	What should be considered in the planning for each phase? When should planning take place?	2.4 (Figs. 2-6 through 2-9)
4.	What is appropriate content for Government CM plans?	Appendix A
5.	What information is prerequisite to effective planning and what is the source of that information?	2.3.1
6.	What is the relationship between Government and Contractor CM planning and management?	2.3.1, 2.3.3
7.	What information needs to be provided to contractor(s) to facilitate contractor planning and to establish economical common information interfaces?	2.3.1, 2.3.2
8.	What information does the Government need to obtain from contractors related to CM planning and implementation?	2.3.3, 2.4
9.	What are the appropriate Government CM activities, and actions to be performed in each phase? What are the criteria for performing them? What are the objectives and benefits?	2.4
10.	What training is required?	2.3.2
11.	What are the methods that can be used to assure that contractors apply effective CM processes?	2.3.3
12.	How should the Government evaluate Contractor CM processes and planning? What are the keys to look for?	2.4
13.	How can process assessment rather than inspection result in reliable consistent CM?	2.3.3
14.	How can the Government evaluate its own CM performance?	2.3.3
15.	Why are continuous assessment and improvement necessary?	2.3.4
16.	What is the benefit of lessons learned? How should they be documented?	2.3.4

2.1 General

A basic principle of management is that responsibility, unlike authority, can not be delegated. The Government Activity [1] and especially its Configuration Manager[2] have the responsibility to ensure that the operating forces are provided with correctly "configured" hardware, software, and the information necessary to operate and maintain them effectively. Regardless of the acquisition concept employed, this responsibility cannot be delegated, nor can it be taken lightly.

The documentation acquired by the Government and the degree of Government detailed involvement in configuration change decisions varies with the acquisition approach being utilized. In the past, contractual imposition of a CM military standard assured that a contractor employed CM practices, and could be held accountable through audit, oversight and other surveillance methods. The Government typically assumed control of configuration documentation in three progressive stages (Functional, Allocated, and Product baselines). The

[1] Government activity responsible for buying, managing, and sustaining the systems and items of hardware and software,

[2]The person(s) responsible for ensuring that the CM process is successfully executed for those systems and items is hereinafter referred to as the Configuration Manager or CM manager.

control consisted of Government CCB approval of any Class I Changes and Government concurrence in Class II changes **[Details Section 4]**, typically by DCMC[3] representatives. By assuming direct control of the baselines the Government could prevent changes that were not beneficial, could not be supported, or were too costly. The Government configuration manager fulfilled his responsibility through a great deal of hands-on management and detailed decision making.

To reduce the cost of weapon system acquisition, relieve the cost premium on contractors for doing Government business, facilitate a common commercial/Government industrial base, and solve the problems relating to equipment obsolescence, Government acquisition practices were revised to adopt industry practices and to include acquisition based primarily on performance specifications. In a performance based acquisition, the Government controls only the specified performance and the critical interfaces of the item, leaving the design solution and its implementation to the contractor. **[Details Section 3]** Only where absolutely necessary will the Government assume configuration control of the product baseline (the design solution). **[Details Section 4]** In addition, there will be no military standard CM requirements or practices with which a contractor must comply. The industry standard for CM, EIA-649 is a guidance document which cites CM principles and best practices; each design activity is required to establish, document and execute a CM process that addresses the CM principles and practices that are applicable to their products. MIL-STD-2549 provides requirements relating only.to the interfaces that must exist for information transactions.

This new approach relieves the Government configuration manager of the burden of much of the hands-on configuration change control processing of change proposals at the detailed design level, described above, but it does not relieve his/her responsibility to the operating forces. The changes in acquisition methods and strategies have no changed the activities to be accomplished as part of the configuration management process.

Given the differences in acquisition concept, and the variations which will occur from program to program, the CM responsibility must be fulfilled using flexible, adaptive and mature management methods. Planning and management techniques are the key to effective implementation of CM. This section describes management activities including planning for, and selecting the key actions to implement (and measure the effectiveness of) configuration identification, control, status accounting and audit, throughout the program life cycle. In describing these key actions, the interfaces to be established and the information needed to perform the actions are identified.

Acquisition methods and strategies often drive the determination of the degrees and levels to which Government and contractor configuration management is applied. There are many options which must be determined during the planning and preparation for an acquisition phase, and definitized in the contract language. This section provides rationale, based on benefit to risk considerations, to help in making appropriate choices.

Implementation concepts and details are referenced by pointers to specific supporting information found in **Sections 3 through 7** (which reflect the major CM functions) and Appendices which support them. For example, Contents of a Government CM plan are delineated in **Appendix A**. The reader is encouraged to use Section 2 as the home base, from which to return after looking up specifics in other sections or appendices.

2.2 Management and Planning Concepts

This section contains a description of the CM process that is shared by both the Government and its contractors; its relationships with the systems engineering and logistics management processes; and the management relationships and activities to be applied across the life cycle.

2.2.1 CM Functional Activity

Figure 2-1 is a top level CM activity model to be used as a reference point to plan and implement the major CM activities (functions) over the program life cycle. **[Lower level details are covered in this Section and in**

[3] Defense Contract Management Command

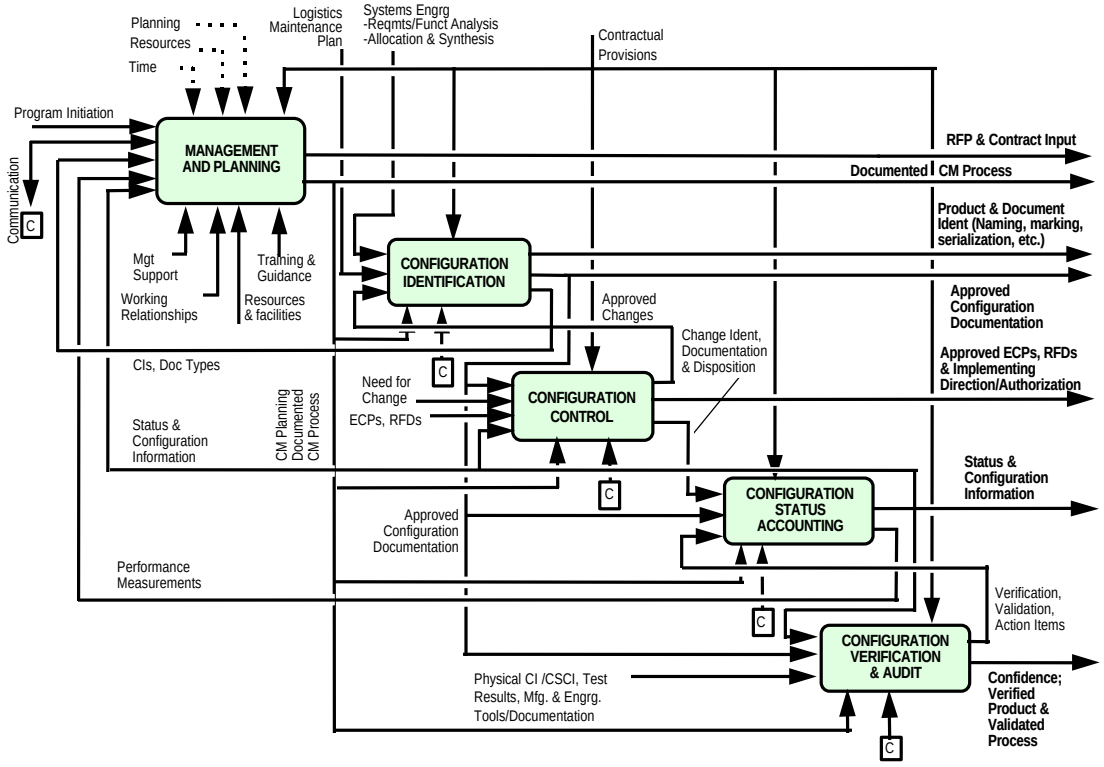


Figure 2-1. Top level Configuration Management Activity Model

Sections 3-7.] It provides an overview of the entire CM process from the Government's perspective and illustrates the relationships within the process. As with all the activity models in this handbook, the format of the model is based on the IDEF0 convention. It shows the inputs (left); outputs (right), constraints (top), and implementing tools or methods (bottom) for each functional CM activity (represented by rectangular boxes).

a. <u>Management and Planning</u> - This block represents the core Government CM activity and its relationships to the other activities. Inputs to Management and Planning consist of the authorization to initiate the CM Program, communications with all of the other CM activities, and selected information and performance measurements received from the status accounting activity.The activity is facilitated by the degree of management support provided, the working relationships established with such other interfacing activities as Government Program Management, Engineering and Logistics, contractor Configuration Management and DCMC. It is further facilitated by the resources and facilities assigned to the function including such resources as automated tools, connectivity to a shared data environment, and other infrastructure elements. Integrated Product and Process Development (IPPD) and the use of Integrated Product Teams (IPTs) by the Government and contractor facilitate the interaction and communications between all parties involved in a common CM process. The training and experience of the personnel and the guidance and resources they have at their disposal are also facilitators.

The Management and Planning process may be constrained by a compressed time schedule for program execution, by a lack of needed people and tools, or by a lack of effective planning. It may also be constrained by contractual provisions which limits the Government CM manager's sphere of control.

The outputs from this activity consist of CM planning informaion and the resultant documented CM process which determine the extent of allocation of the CM functional activities to the contractor and the Government. The need to perform the CM activities, described below, is independent of any specific organizational structure, whether composed of IPTs or conventional functional organizations. The outputs from this Activity also include statement of work language and other information to be inserted in Requests for Proposals and Contracts. If either

Government or contractor configuration management finds itself constrained by contract restrictions, it indicates ineffective planning and coordination of requirements or lack of success in gaining management approval for proposed contract language. **[Details Sections 2.3, 2.4]**

b. Configuration Identification - This activity provides the foundation for all of the other Government CM functional activities. Facilitated by the documented CM process and by open communications, this activity interacts with system engineering **[See 2.2.2]**. Through contractors, IPTs and other means, it provides approved configuration documentation **[Details Section 3]** to document the physical and functional characteristics of the system/item, establishes baselines for Government and contractor configuration control, creates records in the status accounting data base and provides documentation for configuration verification and audit. In addition, product and document identifiers (nomenclature and numbering) are an important output from this activity."

Contractors are expected to have a robust configuration identification activity to define and baseline configuration documents and items at all levels, some of which may transition to Government configuration control depending upon applicable contract provisions. **[Details Sections 3 and 4]** Although not specifically shown in **Figure 2-1**, the data management activity, concerned with the identification, version/revision control, electronic access to, and distribution of all product information, is implicitly related to this activity. **[Details Section 7]**

c. Configuration Control - The Government configuration control process receives input from Configuration Identification defining the current configuration baseline. It receives and processes requests for engineering changes from Government technical, operational and contracts functions, and it receives Engineering Change Proposals and Requests for Deviations from contractors. It also receives requests for modifications to fielded items and facilities from DoD organizational units.

The configuration control activity is constrained by contractual provisions which determine the types and levels of documentation subject to Government configuration control authority. It is facilitated by communications, the documented CM process and by information obtained from the status accounting data base as needed. The CSA information includes the current implementation status of approved changes and other pertinent information concerning the configuration of items in design, in production and in the operational inventory.

This activity may communicate requests for documentation of engineering changes to contractors. It subsequently provides for the review and approval/disapproval of proposed of changes, and for the necessary authorization and direction for change implementation by contractors and affected Government activities. It provides input to status accounting about change identifiers, about the progress of the change documentation through the steps in the configuration control decision/authorization process, and about the implementation status of authorized changes.**[Details Sections 4 and 5]**

d. Configuration Status Accounting (CSA) - All of the other CM activities provide information to the status accounting data base as a by-product of transactions that take place as the functions are performed. Limited or constrained only by contractual provisions and aided or facilitated by the documented CM process and open communications, this activity provides the visibility into status and configuration information concerning the product and its documentation.

The Government CSA information is maintained in a CM data base that is compatible with the interface requirements of MIL-STD-2549. **[Details Section 5]** This database will include such information as the as-designed, as-built, as-delivered, or as-modified configuration of any serial-numbered unit of the product as well as of any replaceable component within the product. Other information, such as the current status of any change, the history of any change, and the schedules for and status of configuration audits (including the status of resultant action items) can also be accessed in the data base.

Metrics (performance measurements) on CM activities are generated from the information in the CSA data base and provided to the Management and Planning function for use in monitoring the process and in developing continuous improvements. To the extent that contractor and Government data bases and processes are integrated, the Government CM Manager may also be able to monitor contractor performance trends.

e. Configuration Verification and Audit - Inputs to Configuration Verification and Audit (Functional and Physical Configuration Audit) include: schedule information (from status accounting), configuration documentation (from configuration identification), product test results, and the physical hardware or software product or its representation, manufacturing instructions, and the software engineering environment. Outputs are verification that (1) the product's performance requirements have been achieved by the product design and (2) the product design has been accurately documented in the configuration documentation. This process is also applied to verify the incorporation of approved engineering changes. Configuration verification should be an embedded function of the contractor's process for creating and modifying the product. Process validation by the Government in lieu of physical inspection may be appropriate.

Successful completion of verification and audit activities results in a verified product and documentation set that may be confidently considered a Product Baseline, as well as a validated process that will maintain the continuing consistency of product to documentation. **[Details Section 6]**

2.2.2 Relation to Systems Engineering Process

Configuration Management is a key element in the System Engineering process, as illustrated in **Figure 2-2** because the System Engineering Process governs the product development and addresses all aspects of total system performance.

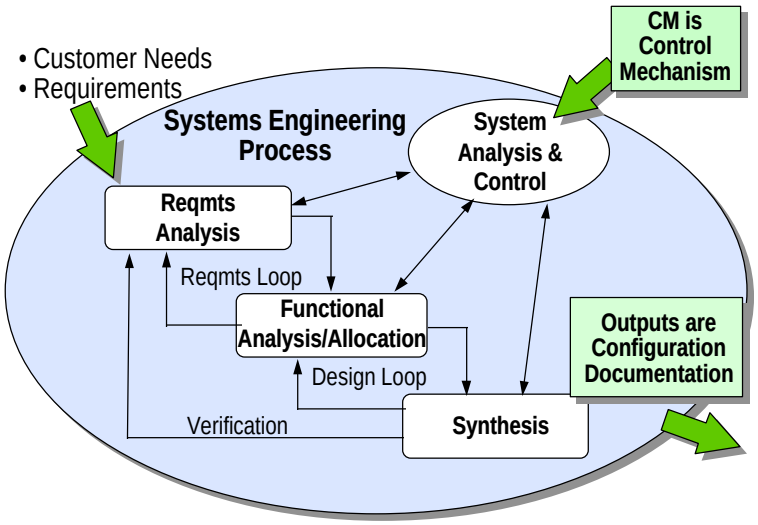


Figure 2-2. How CM Relates to Systems Engineering

In general the system engineering process is associated with operational analysis, requirements definition and design determination. It includes defining the interfaces internal and external to the system including hardware-to-hardware, hardware-to- software and software-to-software interfaces. The tools of system engineering, typically exercised in an integrated product team environment, include:

- **Requirements analysis** - used to determine system technical requirements, and to provide verifiable performance-based requirements in the system utilization environments, and the top level functional requirements that the system must meet.

- **Functional Analysis and Allocation** - integrates the functional system architecture to the depth needed to support synthesis of solutions for people, products, processes, and management of risk. It is conducted iteratively to define successively lower level functions; the lowest level yields a set of requirements that must be performed by components of the system to meet the top level requirements.

- **Synthesis** - commonly understood as preliminary and detailed design, translates the functional and performance requirements into a description of the complete system that satisfies the requirements.

As shown in **Figure 2-2**, the system engineering process uses the "requirements loop" and "the design loop" in an iterative analytic approach to make operational, requirements and design decisions at successively lower levels. As this process iterates, requirements are defined, documented, and approved within the CM process in the form of performance specifications for the Functional baseline, and for the Allocated baselines for specific components of the system identified as configuration items (CI). **[Detail: 3.3]** Outputs of the system engineering process also include the basis for drawings and/or data sets that are released to produce the item and, after verification/audit, form the Product Baseline. Thus system engineering is the process that produces the technical information for which the CM process provides technical control. As the CM process generates requirements for changes, the System Engineering process is exercised to define the technical basis for the change.

2.2.3 Relation to Logistics Process

Also related to systems engineering and a strong component of the Integrated Product Teams is the Acquisition Logistics activity. Support and Maintenance planning, begins prior to Engineering and Manufacturing Development within each IPT and is iterated throughout the life cycle as changes in design and item performance dictate. A significant output of this process is the maintenance plan which articulates the maintenance concept for each item that requires support. Coordination with the logistics planning in general, and with the maintenance planning, in particular, is essential to Configuration Management planning and implementation as illustrated in **Figure 2-3.**

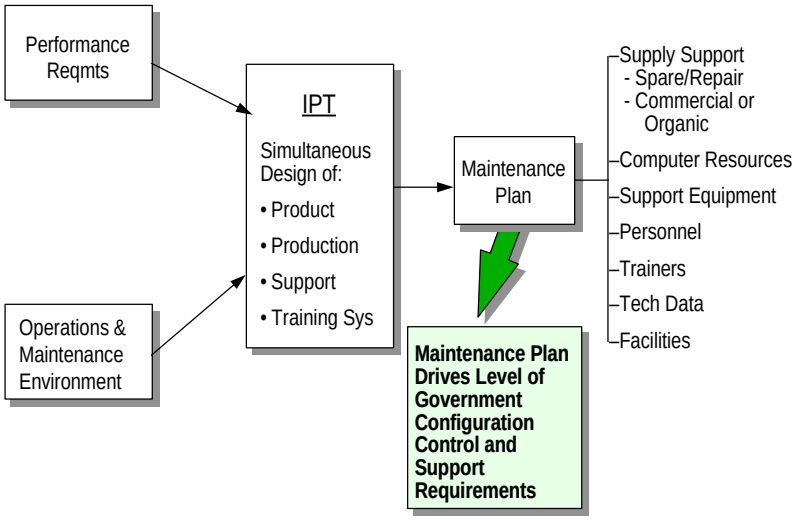


Figure 2-3. How CM Relates to Logistics

The maintenance concept defines many of the factors that must be addressed in a mature logistics system. The maintenance plan is highly dependent on system/component reliability and on volatility of the technology used in the item design. These factors (and many others) are used to determine how the items, which constitute the system/component, will be supported, e.g. throw-away or repair, and commercial or organic repair. The level of items that the Government decides to stock as replacement spares is the major influence on the level of Government configuration control. The maintenance plan includes the life cycle requirements for personnel, training, facilities, support equipment, supply support, and training devices, and influences the information elements that may have to be provided to fully document an engineering change. **[Details Section 4]**

The goal for the Government is to create the proper mix of Government organic support and original equipment manufacturer (OEM) support. The support approach should maintain the desired configuration (form, fit, function, and interface), facilitate tracking of fielded units, provide necessary spares, meet contingency requirements, maintain the technical data, and provide upgrades and improvements that enhance system availability and lower life cycle cost. The lowest equipment indenture level at which the maintenance concept determines that organic

replacement is required, and for which the Government must order spares, determines the lowest level at which the Government needs to obtain performance and over which the Government will exercise Government configuration control. **[Details Section 4]**

2.3 Government Management and Planning Activities

The Government's Management and Planning activities are common to all phases of the program life cycle, although the details upon which that management activity focuses varies from phase to phase. The global activities are illustrated in **Figure 2-4** and described below. The details upon which they focus are described in the CM templates **[See 2.4]**, and in referenced supporting paragraphs in this section, **Sections 3-7**, and **appendices**.

2.3.1 Preparing for the Next Phase

During each phase of the program life cycle, preparation for the following phase takes place. For concept exploration phases this work takes place prior to the initiation of the conception phase, when the requirements for funded study efforts are being formulated.

CM planning is a vital part of the preparation for each phase. CM Planning consists of determining what the CM concept of operation and acquisition strategy for the forthcoming phase will be and preparing or revising the Government's Configuration Management Plan **[Details Appendix A]** accordingly. Configuration Managers must envision future phases and determine what information in the current and immediately following phase must be captured to meet the needs of those future phases.

The CM concept of operation answers questions such as:

- What are the CM objectives for the coming phase?
- What is the rationale for these CM objectives?
- How is each CM objective related to program objectives and risks?
- What is the risk associated with not meeting the objectives?
- How can achievement of the objectives be measured?
- What information is required to support the Government CM goals for the next phase? Future phases?
- How can that information best be obtained?

The CM acquisition strategy addresses the roles and responsibilities of the Government CM activities and the contractor CM activities by answering such questions as:

- What are the deliverables from the next program phase?
- Which deliverables are configuration items? Will contractors propose candidate CIs? How will the final listing of Cis be officially designated?
- What is the end use of each CI?
- How are they to be supported?
- To what extent will they be supported by the Government? By the manufacturer?
- To what level are performance specifications required? CIs? Repairable components? Replaceable components?
- Will the Government prepare performance specifications, or will contractors?
- Who in the contractor organization will be responsible for approving the performance specifications? In the Government organization?
- What level of configuration documentation (e.g. performance specifications, detail specifications, complete technical data package) will be required by the Government by the end of the next phase? By the Contractor?
- What kinds of configuration identifiers (e.g., part numbers, serial numbers, nomenclature, National Stock Numbers) will be required by the Government by the end of the next phase? By the contractor?
- Which baselines (and documents) will already be subject to Government Configuration Control at the start of the next phase?
- What baselines will be established by the contractor during the next phase?, Functional?, Allocated?, Product?

- What documents need to be included in those baselines?
- Will control of any of the baseline documents transfer from the contractor to the Government during the next phase? When is the transfer planned to occur?
- What status accounting will be needed in the next phase?
- Which specific subpackets of information (see the Data Information Packets and Appendix A in MIL-STD-2549) should be provided by the Government? By the contractor?
- Does the program have approval to obtain the information in other than digital format? Will the Government need to have on-line access?

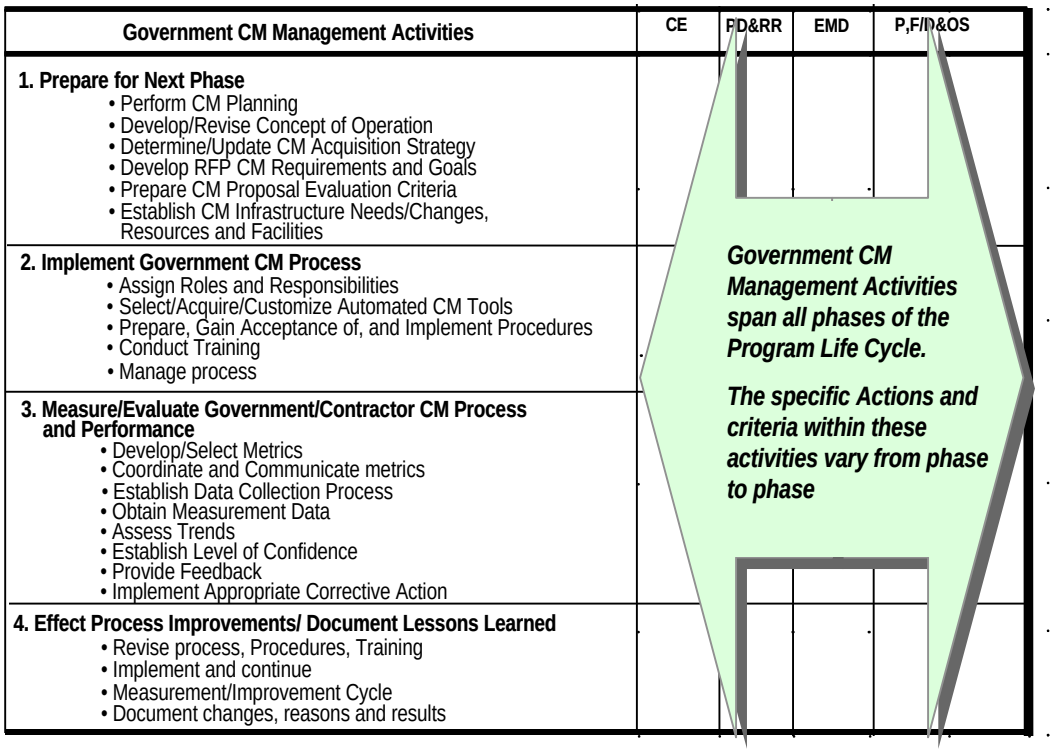


Figure 2-4. Implementation of "Global" Government CM Management Activity

Obviously these questions can not and should not be answered in isolation. They require close coordination, preferably in a teaming atmosphere involving Government Program, Engineering, and Logistic personnel. Where feasible it is desirable to work out planning for future phases within a teaming arrangement with the contractor or contractors participating in the current phase. This provides an opportunity to examine all perspectives on the critical issues and goals in an open atmosphere, and to arrive at an optimum approach.

In addition to enabling the Government CM manager to complete his CM plan, the answers to these questions also provide a rational basis for developing and coordinating configuration management and data management requirements to appear in requests for proposal, and in formulating the criteria to be used to evaluate proposals submitted by contractors. The RFP should be compatible with the Government's CM Plan, however the CM Plan should have sufficient flexibility to enable the CM strategic goals to be met with a variety of responses from contractors.

The RFP also must send the message to the contractor's that the Government is serious about configuration management. It is also one of the best opportunities for the Government CM manager to establish an environment in which contractor CM will have the support of its management. The proposal evaluation criteria (Section L of the RFP) should have Configuration Management as a key management and past performance discriminator. Its weighting should reflect the significance that an effective, documented contractor CM process can have as a risk mitigator.

Preparation for the next phase is not complete until the Government CM Manager determines, and gains commitment for, the resources and facilities that will be needed to implement the Government's CM process. The infrastructure requirements must be adequate to support the program in accordance with the CM concept of operation, and acquisition strategy. The goal is to perform a credible risk analysis in developing the concept of operations which will provide convincing evidence to justify theinvestment in the CM process by showing that the investment will be returned many fold as a result of reduced costs for technical and logistic problems.

2.3.2 Implementing the Government CM Process

During each program life cycle phase, the Government CM Manager implements the planned CM Process. **[Details 2.4]**

The process definition, initiated in the CM planning activity prior to the phase, is now completed by preparing procedures and coordinating them with all participants in the process. Neither Government, nor contractor Configuration Management can be accomplished effectively without the participation and cooperation of many different functional activities. There is no single CM function that does not involve at least two or more interfaces. To accomplish the CM goals requires "team play". One of the best ways to achieve team play is to provide the vision, and solicit cooperative constructive input on the details of the implementing procedures. Each functional area must understand the particular roles and responsibilities that they have in the CM process. The tasks that they are to perform must be integrated into their work flow and given high priority. Coordinating the procedures is the initial step.

Any changes in the Government infrastructure necessary for the performance of CM during the phase are accomplished and tested, including the installation of appropriate automated tools and their integration with the data environment. Personnel from all disciplines and/or integrated product teams are then trained in the overall process and in the specific procedures and tools which they will use. Training pays dividends in a smooth seamless process in which personnel, who understand their roles and the roles of others with whom they interface, work cooperatively treating each interfacing player as a "customer".

Once all of these elements are in place, managing the CM process in the environment of performance based acquisition, IPTs and allocated configuration control authority, still remains a challenging enterprise. The individual IPTs, contractors and other Government activities who are the authority for configuration control of segments of the product design must apply consistent logic to their decision making, and must provide information that can be shared in the common data environment. Once a well thought out plan, and a documented and agreed-to process are in place, the Government CM Manager must employ modern management techniques to assess process effectiveness, assure anticipated results, and fine tune the process as necessary. It is also necessary to maintain the process documentation by updating plans, procedures and training, as required.

It all starts and ends with communication:

- Articulating clear goals and objectives
- Making sure that the various players understand and cooperate
- Providing frequent feedback
- Assuring that current status information, needed to complete process steps, is accessible, and
- Paying attention to the inevitable minor problems which surface.

2.3.3 Measuring/Evaluating Government/Contractor CM Process

Both the Government and the contractor CM process are measured and evaluated using metrics, program reviews, and other means such as Contractor Performance Assessment Reviews (CPARS). Each template in **Section 2.4** provides typical CM objectives for each phase, and typical metrics that may be selected to determine the degree to which those objectives (CM goals) are being met. The objectives help to focus the measurement on the most meaningful and important parameters; the metric presentation provides a level of confidence in the process being measured. Objective oriented metrics should be collected throughout the progress of the entire phase or at least

until the stated objectives are realized. **Figure 2-5** illustrates that CM objectives are related to the Program activity and Program objectives for each phase of the life cycle.

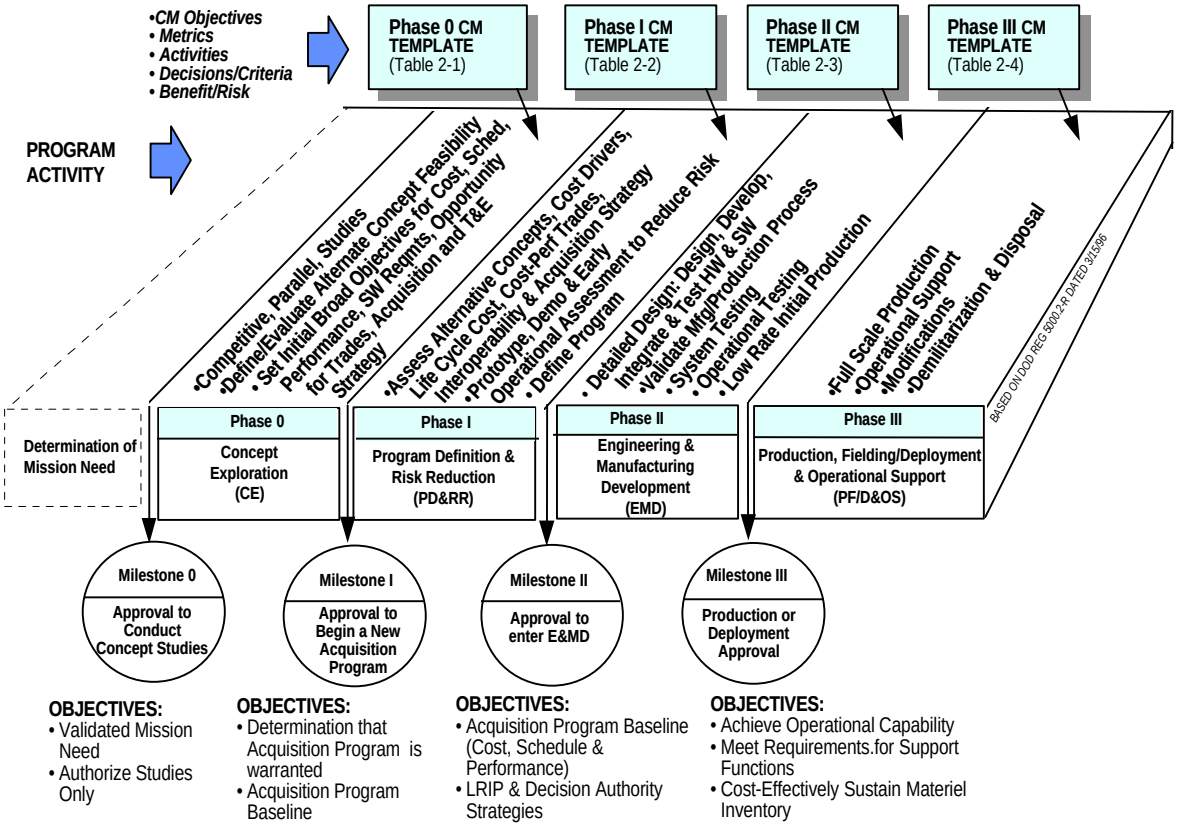


Figure 2-5. CM Objectives for each Phase are Keyed to Program Objectives and Activities

Since the CM Process is a shared enterprise, the Government CM objectives and the Contractor CM objectives should be congruent. The best way to do that is to communicate. During the CM planning for each phase, the Government must articulate the vision and the contractor must realize the seriousness of the intent. The Governments CM objectives should be made available to the contractor(s) for comment before being finalized. The Contractor's CM objectives should be provided to the Government for review as part of the contractors proposal. The ensuing dialog can set the stage for effective CM implementation. Since the DCMC will be the agency to interface with the contractor most directly on metrics and performance measurement issues, they should be involved as a full team member. Ideally, a common set of objectives should be agreed upon by all.

Metrics are key to continuous process improvement. Metrics constitute the data for improvement, i.e. the facts of the process. They enable problems that need attention to be quantified, stratified and prioritized and also provide a basis for assessing the improvements, and assessing trends. A properly constituted set of CM metrics supports both the CM goals and process improvement. Only a few critical items should be used at one time. They should be designed to positively motivate, rather than keep score, and should be forward focused (where are we going) not merely a compilation of past history.

CM by its very nature is cross functional. No important CM function is performed without interaction with other functional or team members. Therefore, CM objectives and measurements cannot and should not be divorced from the interacting systems engineering, design engineering, logistics, contracting and other program objectives and processes. Moreover, it is not the efficiency of CM activities, per se, that add value, but their result in contributing to overall program objectives.

Improving either the Government or industry CM process is a venture that typically requires interaction across a broad spectrum of program activities including technical, financial and contractual. The process must be documented to a level of detail that is:

- Easily understood by all participants in the process
- Focused on the key process interfaces
- Less detailed than the procedures used to perform the process but sufficient to determine what must be measured to obtain factual information on the process.

A metric involves more than a measurement; it consists of:

- An operational definition of the metric which defines what is to be measured, why the metric is employed, when, where and how it is used. It can also help to determine when a metric has outlived its usefulness and should be discontinued.
- The collection and recording of actual measurement data. In the case of the CM process, this step can often be accomplished by query to the status accounting data base, which normally can provide a great deal of process flow information
- The reduction of the measurement data into a presentation format (e.g., run chart, control chart, cause and effect diagram, Pareto charts, histogram) to best illuminate problems or bottlenecks and lead to the determination of root cause or largest constraint.

An effective metric has the following attributes:

- It is meaningful in terms of customer relationships (where the “customer” can be any user of information that is provided.)
- It relates to an organization’s goals and objective, and tells how well they are being met by the process, or part of the process, being measured
- It is timely, simple, logical and repeatable, unambiguously defined, economical to collect.
- It shows a trend over time which will drive the appropriate forward focused action which will benefit the entire organization.

2.3.4 Effect Process Improvement & Document Lessons Learned

We learn from effective measurements and metrics if the process is or is not meeting objectives. We also learn which part of the process is currently the biggest contributor to detected backlogs, bottlenecks, repeat effort, or failures/errors. By focusing on that weakest link, we can isolate the problem and trace it to its root cause. Often the cause can be corrected by streamlining the process (eliminating redundancy or non-value adding steps, modifying sequence, performing tasks in parallel rather than in series) or improving communications. Measurements should continue as is or be altered to fit the new solution for a period of time sufficient to assess if the revised process is resulting in improved performance. This measurement/improvement cycle is an iterative process. Once a weak link is improved, the process metrics are again reviewed to determine and improve other parts of the process which stand out as contributors to deficiencies or lengthy cycle time.

The key personnel involved in the process must be participants in defining the improvements. Their “buy in” is essential if the improvements are to be implemented effectively. Detailed procedures and effected automated systems must be modified and personnel must be re-trained, as required. These “total quality management aspects” of the job are best performed as an integral part of the process of managing, rather than as isolated exercises. It is also foolish to expend effort in improving processes without clearly documenting the lessons learned to leverage the efficiency of future applications Changes made in the process, over time, should be recorded along with the reasons the changes were made and the measured results. A suggested place to record process changes is in the configuration management plan. Initially the CM plan was a projection of the expected implementation of configuration management over the program life cycle. As a minimum, it is updated during each phase for application during the next. Including process change and lessons learned information makes the plan a working document reflecting the transition from anticipated action (planning) to completed action (reality). It can then

serve as a better reference to use in planning for the next program phase and in the initial planning for future programs.

2.4 CM Implementation over the Program Life Cycle

This section consists of a series of templates, one for each life cycle phase, which collectively provide a road map for the CM process. The templates **(Tables 2-1 through 2-4)** portray CM objectives, typical metrics, activities, actions, benefits and risks, decisions to be made and criteria for making them. Actions are cross-referenced to descriptive detail in **Sections 2 through 7.**

Table 2-1. CM Template for Phase 0, Concept Exploration

CM Objectives	Typical Metrics
Government ♦Access to current versions of study reports ♦Defined acquisition strategy and Government CM plan **Both Government and Contractor(s)** ♦Clear coordinated plans for the Program Definition and Risk Reduction (Phase I) **Contractor(s)** ♦Defined CM Process for PD&RR Phase	Checklist of applicable actions to be completed in this phase **[See Table 2-1A]**

ACTIVITY: Management and Planning, Phase 0			
Actions:	**Ref:**	**Decisions/Criteria**	**Benefits/Risks**
Government ♦Develop concept of operation and acquisition strategy for CM in Phase I, Program Definition and Risk Reduction ♦Prepare, coordinate and release procedures implementing Phase 0 Government CM Process; conduct training. (See Govt. activities below.) ♦Measure/evaluate contractor CM process **Contractor and Government** ♦Prepare and coordinate configuration management plans for Phase I ♦Define digital data interface and data requirements for Phase I ♦Document lessons learned during Phase 0. **Contractor** ♦Prepare, coordinate and release procedures to implement contractor CM support of systems engineering during Phase 0; conduct training. (See activities below) ♦Develop Phase I CM requirements, information/data and metrics to be negotiated with potential subcontractors	2.2.3, 2.3.1, Appx A 2.3.2 2.3.3 2.3.1, Appx A, 5.2, 5.3, Sect. 7 2.3.4 1.1, 1.3.1, 2.2.2, 2.2.3, EIA Std 649 2.3.3, Sect 4, 5.2, 5.3, Sect. 7	♦Determine the methods to be used to record and internally control functional, performance and requirements information during Phase I. ♦Determine the unique identifier structure to be used for documentation and products during phase I and succeeding phases ♦Consider the CM information needs of the following phases and develop a time phased approach to its collection and dissemination	♦**Benefit:** - The appropriate level of resources and the right information to efficiently and effectively conduct CM in Phase I ♦**Risks, if not done:** – Incompatible Government and Contractor CM Systems – Inadequate or excessive resources – Inability to perform effectively for lack of timely information

ACTIVITY: Configuration Identification, Phase 0			
Actions:	**Ref:**	**Decisions/Criteria**	**Benefits/Risks**
Government • Implement identification method and review process to review concept exploration studies and draft RFP material. **Contractor and Government** ♦Participate in Program Management and Systems Engineering IPTs **Contractor** ♦Maintain a defined document identification and release process for systems engineering products such as concept study and associated reference documentation. ♦Establish audit trail of decisions and document iterations	3.6.1, 7.2.1 .2.2 .6.1, 3.7.1, 7.2, .2.1-7.2.6, .3.1	♦Table 3-10. Document Identification ♦Table 3-12. Engineering Release ♦Fig. 7-3 Generic Document Identifier Characteristics ♦Decision traceability method	♦**Benefits:** – Efficient management of information – Access to correct, current data – Effective information-sharing among IPTs and between Government and Contractor ♦**Risks, if not done:** – lack of an audit trail of decisions – Incorrect revisions used – IPTs may not be working to a common reference

Table 2-1. CM Template for Phase 0, Concept Exploration, Continued

ACTIVITY: Configuration Control, Phase 0			
Actions:	**Ref:**	**Decisions/Criteria**	**Benefits/Risks**
Contractor and Government ♦ Establish process for version control of concept study data files and document representations ♦ Implement common process to review and coordinate iterations of concept evaluation data	7.2.1-7.2.5 7.2.4	♦ Degree of formality of the change process ♦ Approval and implementation authority ♦ Process flow.	♦ **Benefit:** – Efficient review – Assure that all functional groups or integrated product teams are working to a common reference ♦ **Risks if not done**: – Inconsistent, unreliable, analyses, reports, conclusions
ACTIVITY: Configuration Status Accounting, Phase 0			
Actions:	**Ref:**	**Decisions/Criteria**	**Benefits/Risks**
Contractor and Government ♦ Record and report status of management and technical decisions including designation of individual IPTs responsible for their implementation ♦ Provide traceability of all decisions to revisions in study documents and requirements documentation ♦ Issue unique identifiers for the digital data files and document representations of each document and each hardware model or software package released for use on the program	5.2 7.2.3	♦ Use of a common system/data base by Government and contractor ♦ Capture points in work flow for data attributes ♦ Data access privileges	♦ **Benefits:** – Single information source – Always current reference – Common basis for decision – Access for all with a need to know ♦ **Risks if not done**: – Lack of decision audit trail – Redundant document storage – Decisions based on obsolete data
ACTIVITY: Configuration Audit, Phase 0			
Configuration Audits are not applicable in Phase 0.			

Table 2-1A. Operational Definition of Phase 0 Metric - Checklist of Actions

Metric Title: **Checklist of Phase 0 Actions**	**Process Owner:** Government and Contractor CM Managers
Description (including Data Source, Measurement Method, Frequency): This metric tracks the completion of the actions necessary in Phase 0. It requires a specific selection of the actions listed in Table 2-1, which apply for the product, environment, contractual requirements and CM Planning.	**Data Presentation:** Tabular checklist (See below)
Purpose/Desired Result: Measure completion of Phase 0 activities	**Linkage to Objectives:** This metric links to all Phase 0 Objectives

✓	*CONTRACTOR ACTIONS*	✓	*GOVERNMENT ACTIONS*
	• Using Table 2-1as a guide, tailor a list of specific contractor actions applicable to the program • Assess the completion of Phase 0 actions and the acceptability of resultant processes/information		• Using Table 2-1as a guide, tailor a list of specific Government actions applicable to the program • Assess the completion of Phase 0 actions and the acceptability of resultant processes/information

Table 2-2. CM Template for Phase I, Program Definition And Risk Reduction

CM Objectives	Typical Metrics
Both Government and Contractor(s) ♦ Clear coordinated plans for the EMD Phase ♦ Functional configuration documentation finalized and ready to be baselined **Government** ♦ Define alternative performance requirements with comparable associated life cycle cost, interoperability, and risk assessment data ♦ Access to associated current versions of risk reduction studies and test reports ♦ Defined acquisition strategy and Government CM plan **Contractor(s)** ♦ A defined set of performance requirements (meeting cost and schedule constraints) as a basis for EMD proposal/contract ♦ Defined CM Process for EMD Phase ♦ Major subcontractor performance requirements defined ♦ Subcontractor CM planning for EMD defined and evaluated	1. Checklist of applicable actions to be completed in this phase **[See Table 2-2A]** 2. Evaluation of draft performance documentation (System and top level CI Performance specifications) in terms of: • Identified performance and interface requirements that track to DoD Acquisition Program performance thresholds • Associated verification requirements (to demonstrate the ability to meet or exceed thresholds) defined. • Analysis and modeling data that confirms a high probability of meeting defined requirements **[See Table 2-2B for Operational definition of metric]**

ACTIVITY: Management and Planning, Phase I			
Actions:	**Ref:**	**Decisions/Criteria**	**Benefits/Risks**
Government			
♦ Develop concept of operation and acquisition strategy for Phase II CM	2.2.3, 2.3.1, Appx A	♦ Applicable levels of configuration item identification and control for EMD based on program supportability strategy	♦ **Benefit:** The appropriate level of resources and the right information to efficiently and effectively conduct CM in the EMD Phase
♦ Prepare, coordinate and release procedures implementing the Government CM Process for Phase I; conduct training. (See Govt. configuration identification, control and status accounting activities below.)	2.3.2		♦ **Risks, if not done:** – Incompatible Government and Contractor CM Systems – Inadequate or excessive resources – Inability to perform effectively for lack of timely information – Inappropriate baselines and loss of configuration control – Excessive configuration documentation ordered that is not necessary for Phase II program
♦ Measure/evaluate contractor CM Process	2.3.3	♦ Consider the CM information needs of the following phases and develop a time phased approach to its collection and dissemination	
Contractor and Government			
♦ Prepare and coordinate configuration management plans for EMD Phase	2.3.1, Appx A		
♦ Define digital data interface and data requirements for Phase II	5.2, 5.3, 7.3.2		
♦ Document lessons learned during Program Definition and Risk Reduction	2.3.4		
Contractor			
♦ Prepare, coordinate and release procedures to implement the contractor CM Process for Phase I; conduct necessary training. (See contractor configuration identification, control and status accounting activities below.)	1.1, 1.3.1, 2.2.2, 2.2.3 EIA-649		
♦ Develop EMD Phase CM requirements including information/data and metrics to be negotiated with subcontractors	2.3.3, Sect. 4, 5.2, 5.3, 7.3.2		

Table 2-2. CM Template for Phase I, Program Definition And Risk Reduction, Continued

ACTIVITY: Configuration Identification, Phase I			
Actions:	**Ref:**	**Decisions/Criteria**	**Benefits/Risks**
Government ♦ Establish interface Memoranda of Understanding with associated Government programs/commands, as applicable ♦ Implement identification method and release process for Government requirements and directive documentation. ♦ Review System/Top Level CI Performance Specifications for alternative system solutions **Contractor and Government** ♦ Jointly participate in Program Management and Systems Engineering Integrated Product Teams **Contractor** ♦ Internally control requirements for alternative solutions through a defined document release and control process ♦ Establish requirements traceability from top level to allocated requirements definitions ♦ Prepare, review and provide System and Top Level CI Performance Specifications to the Government ♦ Capture configuration definition of simulation software, prototypes and engineering models through release and control of configuration documents. ♦ Establish interface agreements and Interface control working groups (ICWGs) for interface management.	3.8.1 3.6.1, 3.7.1 2.2.2 3.7.1 3.4.1, 3.4.2 3.7.1, 3.7.2 3.8.1, 3.8.2	♦ Table 3-10. Document Identification (Identification method for simulation software, test articles, prototypes, computer models, etc.) ♦ Fig. 7-3 Generic Document Identifier ♦ Table 3-12. Engineering Release - determine release procedure for requirements documents, test plans, test reports, analyses, trade studies, risk analyses, etc. ♦ Select requirements traceability method or tools ♦ If the program involves more than one Government activity, what should the command relationship or interface methodology be? ♦ If the program involves more than one contractor (or contractor team), what should the contractual or interface relationships be?	♦ **Benefits:** – Efficient management of information – Access to correct, current data – Effective information-sharing and coordination among various IPTs and between Government and Contractor ♦ **Risks, if not done:** – Poor correlation between requirements documents and test results – Incorrect revisions used – IPTs not working to a common reference – Inaccurate, incomplete interface data – Inability to assess requirements iterations on interfaces
ACTIVITY: Configuration Control, Phase I			
Actions:	**Ref:**	**Decisions/Criteria**	**Benefits/Risks**
Government ♦ Implement process to review and coordinate changes to Government requirements definition **Contractor and Government** ♦ Establish an appropriate minimal configuration control process for program performance based requirements being defined and evaluated during this program definition phase. ♦ Maintain Government requirements definition **Contractor** ♦ Implement common process to review and coordinate changes to evolving configuration ♦ Maintain control of requirements definition documents or data bases	4.1.1 4.1.1 4.1.1	♦ Levels of requirements documentation to place under control ♦ Degree of formality of the change process ♦ Approval and implementation authority ♦ Timing transition to new requirements after making decisions. ♦ Process flow.	♦ **Benefit:** – Efficient review of changing requirements both at contractor and between contractor and Government – Assure that all functional groups or integrated product teams are working to a common reference as changes occur ♦ **Risks if not done**: – Inconsistent, unreliable, analyses, tests, simulations, reports

Table 2-2. CM Template for Phase I, Program Definition And Risk Reduction, Continued

ACTIVITY: Configuration Status Accounting, Phase I			
Actions:	**Ref:**	**Decisions/Criteria**	**Benefits/Risks**
Government and Contractor ♦ Record and report the current performance requirement documentation ♦ Correlate definition of simulation software, prototype and or engineering model configurations to applicable test results, analyses, and trade studies ♦ Record and report status of proposed requirement changes including the status of incorporation into the work scope of individual IPTs. ♦ Record all authorized changes to requirements documentation ♦ Access traceability of requirements from the top level documentation through all subordinate levels identified in Phase I ♦ Provide controlled access to the digital data files and document representations of each document and software item released for use on the program	5.2	♦ Table 5-1. Typical CSA Information Over the Life Cycle ♦ Table 5-2 CSA Tasks ♦ Use of a common system/data base by Government and contractor ♦ Capture points in work flow for data attributes ♦ Data access privileges	♦ **Benefits:** – Single information source providing consistency – Always current reference – Common basis for change decision – Access for all with a need to know ♦ **Risks if not done**: – Redundant document storage and retrieval – Costly searches for information and status – Improper decisions made based on obsolete data
ACTIVITY: Configuration Audit, Phase I			
Actions:	**Ref:**	**Decisions/Criteria**	**Benefits/Risks**
Typically, configuration audits are not applicable in Phase I. If determined necessary for critical elements in test or demonstration articles such as flight test demonstrators, tailor the audit actions from the Phase II Audit activity.			

Table 2-2A. Operational Definition of Phase I Metric - Checklist of Actions

Metric Title: **Checklist of Phase I Actions**		**Process Owner:** Government and Contractor CM Managers	
Description (including Data Source, Measurement Method, Frequency): This metric tracks the completion of the actions necessary in Phase I. It requires a specific selection of the actions listed in Table 2-2, which apply for the product, environment, contractual requirements and CM Plans of the program		**Data Presentation:** Tabular checklist (See below)	
Purpose/Desired Result: Measure completion of Phase I activities		**Linkage to Objectives:** This metric links to all Phase I Objectives	
✓	***CONTRACTOR ACTIONS***	✓	***GOVERNMENT ACTIONS***
	• Using Table 2-2 as a guide select a tailored list of specific contractor actions applicable to the program • Assess the degree of completion of Phase I actions and the acceptability of resultant processes/information		• Using Table 2-2 as a guide select a tailored list of specific Government actions applicable to the program • Assess the degree of completion of Phase I actions and the acceptability of resultant processes/information

Table 2-2B. Operational Definition of Phase I Performance Threshold Metric

Metric Title: **Ability to achieve DoD Acquisition Program Baseline Performance Thresholds**	**Process Owner:** Government/Contractor Program Managers
Description (including Data Source, Measurement Method, Frequency): This metric tracks the Acquisition Program Baseline performance thresholds, which are the minimum performance requirements to be met for the program to be able to proceed to the next phase. (There are also cost and schedule thresholds.) **[Ref: DoD Regulation 5000.2-R]** It identifies defined performance requirements which meet or exceed each of the thresholds. It provides a level of confidence by citing the evidence demonstrating the capability to meet the defined requirements through computer modeling, simulation testing (e.g., wind tunnel), analysis, prototype/breadboard testing, prior history, or other means.	**Data Presentation:** Tabular listing of: ♦ Performance thresholds ♦ Quantitative statement of defined performance requirements (which meet or exceed thresholds) and reference to where defined. ♦ If and How Capability to meet the defined requirements is demonstrated (with reference to objective or subjective data
Purpose/Desired Result: Provide the correlation between the Phase I objectives and the documented and demonstrated achievement of those objectives	**Linkage to Objectives:** This metric links directly to the primary objectives of Phase I, which are to define the performance based program requirements meeting performance, cost and schedule thresholds with the least risk

Table 2-3. CM Template for Phase II, Engineering and Manufacturing Development

CM Objectives	Typical Metrics
Government ♦ Effective Government CM process in place ♦ Confidence in Contractor(s) CM process ♦ Functional baseline established and under Government configuration control for Systems/Subsystems ♦ Allocated baselines established and under Government configuration control for top level CIs and other CIs whose performance requirements are to be controlled by the Government during this phase ♦ Product baselines established and under Government configuration control for CIs whose detail design is to be controlled by the Government ♦ Government CSA data base established with data content (data elements and relationships) appropriate for EMD and the Production, Fielding/Deployment and Operational Support Phase ♦ All data requirements for phase III defined and negotiated **Both Government and Contractor(s)** ♦ Performance specified and allocated ♦ Documented performance achieved and verified ♦ Joint Functional Configuration Audit completed per plan ♦ Defined and verified product configuration ♦ Allocated and Product baselines under appropriate configuration control authority ♦ Contractor CSA can provide required data meeting Government conceptual schema (data elements and relationships)**[Ref: MIL-STD-2549]** **Contractor(s)** ♦ Documented and Validated CM process in place ♦ Allocated baselines established and under Contractor configuration control for CIs whose performance requirements are to be controlled by the Contractor ♦ Design documentation and changes controlled via an effective release system ♦ Verification activities including Functional and Physical Configuration Audits, when required, completed per plan. ♦ Product baselines established and under Contractor configuration control for CIs whose detail design is to be controlled by the Contractor ♦ Contractor status accounting data base operational with data content (data elements and relationships) appropriate for both EMD and the Production, Fielding/Deployment and Operational Support Phase.	♦ Checklist of CM actions to be completed prior to each major development event for the system and each CI, as applicable, e.g.: – Functional Baseline – Allocated baseline(s) – CI/CSCI Integration – Significant Operational or Flight Tests – Functional Configuration Audit – Physical Configuration Audit **[See Table 2-3A for operational definition of metric.]** ♦ ECP Cycle time (may be stratified by $ value or complexity factors, ECP Priority codes or ECP Justification codes) **[See Table 2-3B for metric operational definition of metric.]** ♦ Rate of Class I ECP Approval **[See Table 2-3C for operational definition of metric.]** Contractor CCB Government CCB ♦ Number/Percentage of Deviation Requests **[See Table 2-3D for operational definition of metric.]** ♦ Number of Configuration Audits planned, held, successfully completed (all actions); Open actions remaining per audit. **[See Table 2-3E for operational definition of metric.]** ♦ Change Incorporation Rate - Volume of un-incorporated (unverified) engineering changes vs target for test articles and low rate initial production units. **[See Table 2-4B for operational definition of metric.]**

Table 2-3. CM Template for Phase II, Engineering and Manufacturing Development, Continued

ACTIVITY: Management and Planning, Phase II			
Actions:	**Ref:**	**Decisions/Criteria**	**Benefits/Risks**
Government ♦ Develop concept of operation and acquisition strategy for Phase III CM ♦ Prepare, coordinate and release procedures implementing Phase II Government CM Process; conduct training. (See Govt. activities below.) ♦ Measure/Evaluate Contractor CM Process	2.2.3, 2.3.1, Appx. A 2.3.2 2.3.3, 3.1.2, 4.1.2, 5.3, 6.3	♦ Applicable levels of CI item identification and control for Phase III based on program supportability strategy. See Fig. 2-3. ♦ Table 3-1. Config. Ident. Process Eval. Checklist ♦ Table 4-1. Config. Ctrl. Process Eval. Checklist ♦ Table 5-2. CSA Process Eval. Checklist	♦ **Benefit:** – The appropriate level of resources and the right information to efficiently and effectively conduct CM in Phase III ♦ **Risks, if not done:** – Incompatible Government and Contractor CM Systems – Inadequate or excessive resources – Inability to perform effectively for lack of timely information – Loss of configuration control – Poor supportability – Excessive configuration documentation ordered that is not necessary for program management or sustainment
Contractor and Government ♦ Prepare and coordinate configuration management plans for Phase III ♦ Define digital data interface and data requirements for Phase III ♦ Effect process improvements and document lessons learned during Engineering and Manufacturing Development	2.3.1, Appx A, A.2.1, A.2.2 5.2, 5.3, Sec 7 2.3.4	♦ Table A-2 Government CM Plan ♦ Table A-3 Contractor CM Plan ♦ Consider the CM information needs of Phase III and refine approach to its collection and dissemination	
Contractor ♦ Prepare, coordinate and release procedures to implement the contractor CM Process for Phase II; conduct necessary training. (See contractor configuration identification, control and status accounting activities below.)	1.1, 1.3.1, 2.2.2, 2..2.3, EIA Std 649		
♦ Finalize Phase III CM requirements including subcontractor information/data and metrics	2.3.3, 3.1.1, 4.1.2, 5.3, 6.3 2.3.3, 5.2, 5.3, Sects. 4 & 7	♦ Tables 3-1, 4-1, 5-2 (See above)	
ACTIVITY: Configuration Identification, Phase II			
Actions:	**Ref:**	**Decisions/Criteria**	**Benefits/Risks**
Government ♦ Approve System Specification establishing Functional Baseline ♦ Concur with contractor specification types ♦ Approve top-level and lower-level CI performance specifications for which the Government has configuration control authority, establishing a (Government) Allocated Baseline for each CI For CIs for which Government is configuration control authority at detail design level, establish (Government) Product Baseline (after CI performance verification and documentation/product consistency).	3.4.1, 3.4.2, 3.5.1, 3.5.2	♦ Table 3-2. CI Select. Crit. ♦ Fig. 3-3. Selection. of. Specification Types ♦ Table 3-3. Order of Precedence for Specs. ♦ Table 3-4. Spec. Types Categorized by Source ♦ Table 3-5. Spec. Types Categorized by Utility ♦ Table 3-6 Spec. Types Categorized by Object ♦ Table 3-7. Spec. Types Categorized by Purpose	♦ **Benefit:** – Known structure (hierarchy) of system/CI to which configuration documentation and other information is related – Performance, interface and other attributes are clearly documented – Items are identified and marked at an appropriate level – Identification of product

Table 2-3. CM Template for Phase II, Engineering and Manufacturing Development, Continued

ACTIVITY: Configuration Identification, Phase II			
Actions:	**Ref:**	**Decisions/Criteria**	**Benefits/Risks**
		♦Table 3-13 Govt Acq. of Detailed design Data	and documentation are modified as significant changes are incorporated
♦Assign Nomenclature, where appropriate	3.6.3	♦Table 3-11. Item Ident.	– Release of configuration documents is control led and configuration baselines are established and maintained
♦Assign representatives, establish and operate Interface Management Boards or other mechanisms to coordinate contractual and technical interface issues among related Service Components and Commands	3.8, 3.8.1, 3.8.2	♦Table 3-14. Doc. Defining Interfaces ♦Table 3-15. Interface Mgmt. Process Matrix ♦Fig. 3-6. Interface Mgmt. Process Flow	– Configuration documentation, user, and maintenance information correlate to product versions
♦Participate in Contractor ICWG activity			
Contractor and Government			
♦Determine configuration control authority for configuration documentation for each CI, based on maintenance and support plans and CM plans.	3.1, 4.1.1.1 2.2.3	♦Fig. 2-3. How CM Relates to Logistics	♦**Risks, if not done:**
Contractor			– Incomplete documentation
♦Define product structure identifying CIs and configuration documentation	3.2, 3.2.1, 3.3, 3.3.1, 3.3.2	♦Table 3-2 Tiering of CI Designations	– Inadequate or incorrect product identification and marking
♦Assign CI Identifiers/Nomenclature			– Inconsistency between product and documentation
♦Determine type of specification(s) for each CI (See Criteria for Types & Order of Precedence)		♦Fig. 3-3, Tables 3-3 through 3-7	– Inability to validate performance and interface attributes
♦Assign specification identifiers	3.6.1, 3.6.2	♦Table 3-10. Doc. Ident.	– Inability to distinguish between product versions
♦Define interfaces using ICWGs/ICDs as applicable	3.8, 3.8.1, 3.8.2	♦Table 3-14, Table 3-15, Fig. 3-6.	– Inadequate basis for defining changes and corrective actions
♦Prepare and coordinate CI specifications, obtain approval by all affected functional organizations and teams	3..5, 3.5.1, 3.5.2	♦Table 3-9. Software Documentation ♦Figs 3-4a.-e. Baseline Concepts	– Configuration control authorities not established or defined inappropriately
♦Approve CI performance and/or detail specification for each CI for which contractor has configuration control authority, establishing a (Contractor) Allocated Baseline			– Uncertain configuration control decisions
♦Assign part/item and software identifiers	3.6.3	♦Table 3-11. Item Identification	– Inability to provide efficient product support after production and deployment
♦Define traceable items and prescribe method of tracking identification (serial or lot control)			
♦Release engineering design data (Engineering drawings, computer models, software design documents)	3.7.1, 3.7.2	♦Table 3-12 Eng. Release Rec. Content & Funct.Cap .	
♦Maintain design release baseline (also referred to as developmental configuration and release record) and baseline for each software version	3.5.1, 3.5.2	♦Table 3-8. Eng. Dwgs. & Associated lists	
♦For CIs for which the contractor is the configuration control authority at the detail design level, establish (Contractor) Product Baseline (after verifying CI performance and CI documentation/product consistency).	3.1, 4.1.1.1 6.1, 6.2, 6.2.1	♦Fig. 3-4 a.-e. ♦Fig. 6-2. Change Implementation & Verification	

Table 2-3. CM Template for Phase II, Engineering and Manufacturing Development, Continued

ACTIVITY: Configuration Control			
Actions:	**Ref:**	**Decisions/Criteria**	**Benefits/Risks**
Government			♦ **Benefits:**
♦ Establish Government configuration control process and procedures for Phase II, including Change Initiation, Evaluation, and Disposition.	4.1, 4.1.1	♦ Fig. 4-1. Config. Control Process Activity Model ♦ Fig. 4-2. Govt. ~ Change Initiation Activity Model	– Efficient change processing & orderly communication of change information
♦ Establish CCB using CCB Charter; assign membership, provide operating procedures	4.1.1.3	♦ Fig. 4-4. Govt. ~ Change Eval. & Disposition Activity Model	– Change decisions based on knowledge of change impact
♦ Evaluate contractor configuration control process	4.1.2	♦ Table 4-1. Config.Control Process Eval. Checklist	– Changes limited to those necessary or beneficial
♦ When necessary or beneficial to the Government, initiate requests for Class I ECPs to Functional Baseline configuration documentation and Allocated Baseline configuration documentation for which the Government is the configuration control authority	4.1.1.1, 4.1.1.2, 4.2.1, 4.2.1.1, 4.2.2	♦ Table 4-2. Change Class. ♦ Table 4-3. ECP Just. Codes ♦ Table 4-4 . Class I ECP Types And Their Function ♦ Table 4-5. ECP Priorities ♦ Table 4-6. ECP Content	– Evaluation of cost, savings and tradeoffs facilitated – Consistency between product & documentation – Configuration control preserved at system interfaces
♦ Determine desired change effectivity	4.1.1.4	♦ Table 4-7. ECP Review and Disposition Actions	– Current baselines enable supportability
♦ Coordinate, evaluate and disposition contractor's Class I ECPs and NORs (as applicable)	4.2.1.4, 4.4	♦ Table 4-10, NOR Content	– Deviations are documented and limited
♦ Direct contractual implementation of approved ECPs, in accordance with the approved effectivity, into configuration documentation, System, CIs, and all supporting commodities and services that are effected by the ECP	4.2.1.5	♦ Table 4-8. ECP Implementing Actions	♦ **Risks, if not done:** – Chaotic, ad-hoc change management – Changes approved without knowledge of significant impacts – Changes that are not necessary or offer no benefit – Lack of confidence in cost, schedule estimates – No assurance of product to document consistency – Uncertainty at system interfaces – Inconsistent basis for supportability – No control of deviations – Ineffective program management – Lack of confidence in both Government and contractor process – Essentially, technical anarchy
♦ Review and approve or disapprove contractor requests for deviation from Government approved configuration documents	4.3, 4.3.1, 4.3.2	♦ Table 4-9. RFD Content	
Government/Contractor			
♦ Communicate on status and content of changes and deviation requests contemplated and in process	4.1, 4.2.1.1	♦ Appx G. ECP Mgt. Guide	
Contractor			
♦ Establish Contractor configuration control process and procedures for phase II including CCB, change identification, change evaluation and coordination and approved change implementation and verification	4.1, 4.1.1 4.1.1.3	♦ Fig. 4-1. Config. Control Process Activity Model ♦ Fig. 4-3 Contractor Conf. control Activity Model	
♦ Evaluate sub-contractor configuration control process	4.1.2	♦ Table 4-1 Conf. Control Process Eval. Checklist	
♦ Process proposed changes to approved baseline configuration documentation: – Identify, classify and document change – Evaluate and coordinate change – Assess change impact – Determine proposed effectivity, schedule, and cost	4.1.1, 4.1.1.1 through 4.1.1.4 4.2, 4.2.1, 4.2.1.1 through 4.2.1.4	♦ Table 4-2. Change Class. ♦ Table 4-3. ECP Just. Codes ♦ Table 4-4 . Class I ECP Types And Their Function ♦ Table 4-5. ECP Priorities ♦ Table 4-6. ECP Content ♦ Table 4-7. ECP Review and Disposition Actions	

Table 2-3. CM Template for Phase II, Engineering and Manufacturing Development, Continued

ACTIVITY: Configuration Control, Phase II			
Actions:	**Ref:**	**Decisions/Criteria**	**Benefits/Risks**
– For proposed changes to the Functional Baseline, submit Class I ECPs with attached NORS, if applicable			
– For proposed changes to an Allocated Baseline • Where the Government is the configuration control authority, submit Class I ECPs with attached NORS, if applicable • Where the contractor is the configuration control authority, obtain a change approval decision from the appropriate organizational level with authority to commit resources to implement the change	4.4, 4.4.1, 4.4.2	♦Table 4-10. NOR Content	
♦For design changes to developmental configuration, assess the change, as part of the release process, to assure that Functional or Allocated Baselines are not impacted	4.2.1.5	♦Table 4-8. ECP Implementing Actions	
♦Plan change implementation	4.2.1.5		
♦Implement change and verify re-established consistency of product, documentation operation and maintenance resources	4.3, 4.3.1, 4.3.2	♦Table 4-9. RFD Content	
♦If necessary to depart temporarily from Government approved configuration documents, process and submit Requests for Deviation as required • Classify as major or minor • Document and submit to the configuration control process • Obtain approval decision from the appropriate authority – The Government - if it is a major deviation to a Government approved configuration document (i.e. PRF or DTL Specifications) – The DCMC (or other contractually designated authority) if is a minor deviation to a Government approved configuration document - The appropriate contractor internal authority if the deviation is to contractor baselined configuration documentation			

Table 2-3. CM Template for Phase II, Engineering and Manufacturing Development, Continued

ACTIVITY: Configuration Status Accounting, Phase II			
Actions:	**Ref:**	**Decisions/Criteria**	**Benefits/Risks**
Government			
♦ Select and tailor data packets of information to be provided by the contractor for Phase III	5.1, 5.2, 5.3	♦ Table 5-1. Typical CSA Information Over the Life Cycle ♦ Table 5-3 CSA Tasks	♦ **Benefit:** – Correct, timely configuration information, when needed to facilitate decision making on changes, deployment of assets, determining applicable replacements, performing updates/upgrades.
♦ Establish procedures and screens for interacting with the Government CM AIS			
♦ Test and assure the integrity of the configuration information in the Government data base(s); verify that CM business rules have been correctly applied		♦ Table 5-2. CSA Process Eval. Checklist	
♦ Evaluate contractor CSA Process	5.3		
Government/Contractor			
♦ Identify the current approved configuration documentation and configuration identifiers associated with each System/CI(s).	5.2, 5.3	♦ Table 5-3. Configuration Status Accounting Tasks ♦ Tables 5-4 Tailoring of MIL-STD-2549 Information Packets	
♦ Identify the digital data file(s) and document representations of all revisions/versions of each document and software delivered, or made accessible electronically, in support of the contract.			♦ **Risk, if not done** – The risk of inadequate status accounting may result in improper decisions about change effectivity, retrofit requirements, deployment of items requiring support assets that are not in place; all of which contribute to avoidable cost.
♦ Record and report the results of configuration audits to include the status and final disposition of identified discrepancies and action items			
♦ Record and report the status of proposed engineering changes from initiation to final approval to contractual implementation			
♦ Record and report the status of all critical and major requests for deviation that affect the configuration of a system/CI(s).			
Contractor			
♦ Capture and report information about: – Product configuration status – Configuration documentation – Current baselines – Historic baselines – Change requests – Change proposals – Change notices – Variances – Warranty data/history – Replacements by maintenance action – Configuration verification and audit status/action item close-out	5.1, 5.2, 5.3	♦ Table 5-1. Typical CSA Information Over the Life Cycle ♦ Table 5-3. Configuration Status Accounting Tasks ♦ Tables 5-4 Tailoring of MIL-STD-2549 Information Packets	
♦ Report the effectivity and installation status of configuration changes to all system/CI(s)			
♦ Provide the traceability of all changes from the original released configuration documentation of each System/CI(s)			
♦ Record and report implementation status of authorized changes		Table 5-2 CSA Process Eval. Checklist	
♦ Evaluate Sub-contractor CSA process	5.3		

Table 2-3. CM Template for Phase II, Engineering and Manufacturing Development, Continued

ACTIVITY: Configuration Audit, Phase II			
Actions:	**Ref:**	**Decisions/Criteria**	**Benefits/Risks**
Government ♦ Assign Audit co-chair for each audit ♦ Approve audit agenda(s) ♦ Approve minutes ♦ Certify contractors processes for Engineering Release, Configuration Control and Status accounting as adequate to maintain baseline control	6.1, 6.2, 6.2.1, 6.2.2, 6.2.2.1-6.2.2.3	♦ Table 6-1, Audit planning and Pre-Audit Preparation ♦ Table 6-2 Conducting Configuration Audits ♦ Figure 6-3. Audit Certification Package Content	♦ **Benefit:** – Verified configuration and documentation consistent with operational and support requirements – Reliable and dependable baselines ♦ **Risk, of not doing:** – Unnecessary and avoidable support costs – Inaccurate technical manuals – Replacement parts that do not fit – Loss of confidence in supplier.
Government/Contractor ♦ Perform audit planning and pre-audit preparation ♦ Conduct formal audit when required ♦ Review performance requirements, test plans, results, other evidence to determine product performs as specified, warranted & advertised ♦ Perform physical inspection of product and design information; assure accuracy, consistency & conformance with acceptable practice ♦ Record discrepancies; review to close out or determine action; record action items ♦ Track action items to closure via status accounting	6.3	♦ Table 6-1, Audit planning and Pre-Audit Preparation ♦ Table 6-2 Conducting Configuration Audits ♦ Table 6-3. Post Config. Audit Actions/Audit Close-out	
Contractor ♦ Verify product within normal course of process flow ♦ Assure consistency of release information and production/modification information ♦ Assign audit co-chair ♦ Prepare audit agendas ♦ Prepare audit minutes	6.2.1 6.3	♦ Fig. 6-2. Change Implementation and Verification ♦ Table 6-1, Audit Planning and Pre-Audit Preparation ♦ Table 6-2 Conducting Configuration Audits	

Table 2-3A. Operational Definition of Phase II Checklist of CM Actions Metric

Metric Title: Checklist of CM Actions Prior to Major System and CI Development Events			**Process Owner:** Government and Contractor CM Managers
Description (including Data Source, Measurement Method, Frequency): Program unique checklist to be checked off as actions required prior to applicable events are completed. Actions listed should be consistent with CM planning and program schedules.			**Data Presentation:** See Checklist model below.
Purpose/Desired Result: The purpose of this metric is to assure that the actions necessary to implement the CM process during the Engineering and Manufacturing Development phase of the program are appropriately planned and completed per schedule.			**Linkage to Objectives:** This metric links to all Phase II CM objectives
✓	**CONTRACTOR ACTIONS-CHECKLIST**	✓	**GOVERNMENT ACTIONS CHECKLIST**
	List CM Actions to be completed prior to: ♦ Functional Baseline ♦ Allocated baseline(s) ♦ CI Testing ♦ CSCI Testing ♦ Integration Test ♦ First Flight ♦ Operational/Flight Test ♦ Functional Configuration Audit ♦ Physical Configuration Audi *EXAMPLES ONLY*		List CM Actions to be completed prior to: ♦ Functional Baseline ♦ Allocated baseline(s) ♦ GDT&E ♦ Clearance for flight ♦ Functional Configuration Audit ♦ Physical Configuration Audit ♦ OPEVAL ♦ CI Delivery and Acceptance ♦ RFP for Phase III ♦ Phase III Contract Award *EXAMPLES ONLY*

Table 2-3B Operational Definition of ECP Cycle Time Metric

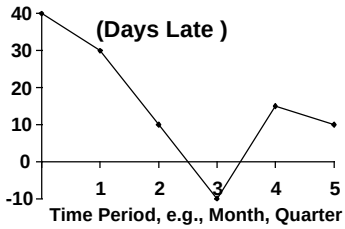
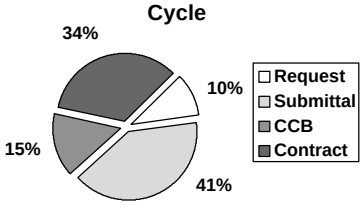
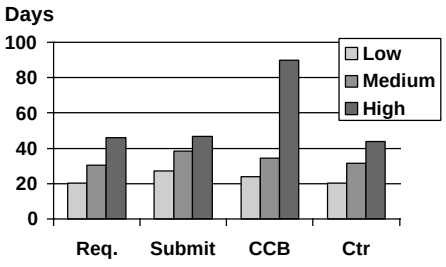
Metric Title: ECP Cycle Time	**Process Owner:** Government CM Manager(G)/ Contractor CM Manager
Description (including Data Source, Measurement Method, Frequency): a. Actual Total (Class I) ECP cycle time compared to targets: • From determination of need until ECP is requested or initiated • ECP request/initiation to submittal • ECP submittal to Govt CCB • CCB approval to Contractual direction/modification This measurement encompasses the entire ECP cycle in terms of the number of calendar days between significant events. Data may be derived completely from information (dates) that is available to the Government CM manager. Typically these data are compiled monthly. Targets that the data are compared derive from averaging the scheduled periods for each ECP. b. Actual Contractor ECP cycle time between major process milestones, compared to targets, e.g., • Request • IPT Technical definition complete • Estimating and Pricing complete • CCB • Submittal This measurement encompasses the contractor portion of the ECP cycle in terms of the number of calendar days between significant milestones in the process. (Each contractor process may vary.) c. Actual Government cycle time (after contractor submits ECP) between major milestones, compared to targets, e.g. • Receipt • Staffing & Evaluation complete • CCB • Contractual authorization This measurement encompasses the Government portion of the ECP cycle in terms of the number of calendar days between significant milestones in the process.	**Data Presentation:** a. Data are typically presented as (1)a plot of average time variance from scheduled time, (2) a pie chart showing percentage of time spent in portions of the cycle, or (3) bar charts showing portions contributing to lateness. This data may be stratified by ECP $ value, complexity factors, ECP Priority codes, or ECP Justification codes to determine the influence of such factors on processing time. **Average Variance from Schedule**  (1) **Percentage of Time in Portions of Cycle**  (2) **Portions of Process Contribution to Lateness (Stratified by $ Value)**  (3) b. & c.. Data presentation similar to a.
Purpose/Desired Result: Shows the total time spent in the ECP Cycle including both Government and Contractor Activity . It shows which portions of the ECP cycle are the longest, focuses attention on ECP processing, and highlights areas of inefficient process or insufficient priority. It also isolates contributing factors and constraints, concentrates improvement effort where it will benefit the entire process, and shows the effectiveness of improvements measured over time.	**Linkage to Objectives:** This metric links to the common Government and Contractor objective to provide efficient and timely processing of ECPs and Requests for Deviations.

Table 2-3C Operational Definition of ECP Approval Rate Metric

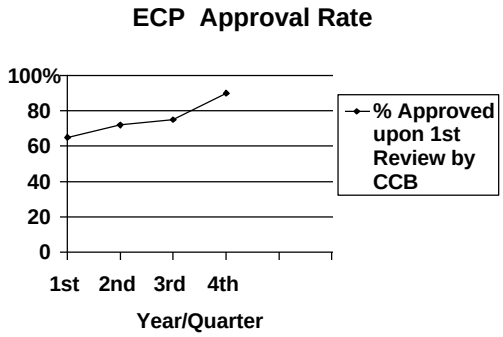
Metric Title: ECP Approval Rate	**Process Owner:** Government and Contractor CM Managers (Jointly and Separately)
Description (including Data Source, Measurement Method, Frequency): This metric applies only to Class I ECPs. To obtain a measure of the rate of first pass approvals in any time period, count the number of ECPs that are approved upon first submittal to a CCB, and divide by the total number submitted. Do not count ECPs that are revised and resubmitted as first pass approvals. Average the results over time. The same process can be applied to contractor's internal CCB, and to the Governments CCB. The former measures the internal approval rate and the latter, the approval rate by the Government. Data for this metric should be available from status accounting records relating to CCB scheduling and processing of ECPs. Monthly or Quarterly compilation is typical, depending upon change volume. Additionally, the rate of disapproval may be measured by dividing the total disapproved in a time period by the total submitted.	**Data Presentation:** 
Purpose/Desired Result: The purpose of this metric is to highlight the degree of, or lack of coordination between customer (the Government) and supplier (the Contractor) of ECPs. Typically a low approval/high rejection rate indicates that there has been insufficient agreement on the scope and nature of the proposed change prior to the initiation of the request for ECP, or the initiation of the proposal. The desired result is improved communications leading to a significant reduction in the number and associated processing cost of ECPs that are disapproved or require rework to make them successful.	**Linkage to Objectives:** This metric links to the common Government and Contractor objective to provide efficient and timely processing of ECPs and Requests for Deviations.

Table 2-3D Operational Definition of Deviation Performance Metric

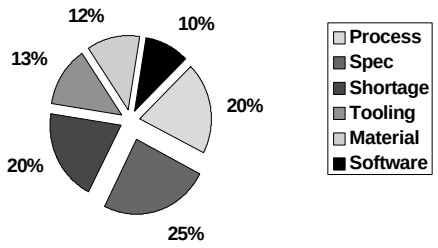
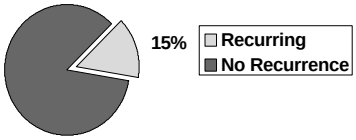
Metric Title: Number of Deviation Requests and Percentage Recurring	**Process Owner:** Contractor CM Manager/DCMC
Description (including Data Source, Measurement Method, Frequency): To measure the volume of deviation requests, count the number of deviation requests in each reporting period. Categorize and stratify the data by reasons for the deviation request in order to identify the most frequent causes. Count the number of times that a deviation recurs (i.e. the same variance is requested for a second or third range of end items as was previously requested).	**Data Presentation:** **Deviations by Root Cause**  **Percent Deviations Recurring One time or More** 
Purpose/Desired Result: The purpose of this metric is to determine and isolate the causes of excessive and recurring deviation requests. The desired result is to determine the process steps or technical area contributing the most to the number of deviations and to the recurrence of deviations so that appropriate corrective action or process improvement can be effected. This metric may also be used by the Government to assess Contractor performance.	**Linkage to Objectives:** This metric links to the common Government and Contractor objective to provide efficient and timely processing of ECPs and Requests for Deviations and Waivers.

Table 2-3E Operational Definition of Configuration Audit Metric

Metric Title: Number of Configuration Audits/ Open Actions	**Process Owner:** Government and Contractor CM Managers (Jointly)
Description (including Data Source, Measurement Method, Frequency): This metric measures the number of scheduled, performed and completed configuration audits during the current phase of the program life cycle. It also measures the completeness and speed of follow-up action required to completely close out each audit.	**Data Presentation:** (Tabular) **CI** *CI Ident* — **AUDIT TYPE** *(FCA PCA)* — **DATE** *Sched, Actual, Date* — **STATUS** *Open Compl etc.* — **RESP** *Actionee* — **REQD ACTIONS** *Action Descrip'n* — **DAYS OPEN** *#Days Since Audit* **SUMMARY**: *# Open* _____ *(Avg.)** _____ *Plot trend by audit type, contractor, etc. as applicable
Purpose/Desired Result: The purpose of this metric is to highlight the importance of • verifying that the fuctional and physical requirements have been met • the documentation matches the product • the product baseline configuration is being maintaining, and, concurrently that: • Audit participants are completing assigned actions necessary to bring the audits to a satisfactory closure	**Linkage to Objectives:** This metric links to the Government and contractor objectives: • Documented performance achieved and verified • Joint Functional Configuration Audit completed per plan • Defined and verified product configuration • assurance that contractor(s) has established and is maintaining a Product Baseline for each CI and that there is a known configuration of all CIs in the operational inventory. (Note: This metric is common to both Phase II and Phase III)

Table 2-4. CM Template for Phase III, Production, Fielding/ Deployment and Operational Support

CM Objectives	Typical Metrics
Government ♦ Assurance that contractor(s) has established and maintains a Product Baseline for CIs for which contractor is configuration control authority for the detail design. ♦ Establish Product Baseline for CIs for which Government is configuration control authority for the detail design ♦ Known configuration of all CIs in operational inventory (down to lowest organically replaceable parts) ♦ Present and planned allocation of CI assets by S/N to operational sites, squadrons, wings, corps, etc. ♦ Access to operation and maintenance information for the current configuration (down to the lowest organically replaceable parts) of each deployed CI or CSCI version; knowledge as to approved ECPs incorporated ♦ Reference to correct configuration of support assets (support equipment, test program sets, trainers and associated software) required for each operational configuration of each CI to the extent that it is organically supported. ♦ Ability to determine the current mission capability of each CI S/N reflected by installed software version, ECP (& modification kit) incorporation, and local insertion of mission data. ♦ Known configuration, (quantities and location) of spare and replacement parts for current configuration, and mod kits to upgrade to new (baseline) configuration ♦ Access to design disclosure data for spare parts to be re-procured to detailed design rather than performance data. **Both Government and Contractor(s)** ♦ Current Functional and Allocated Baseline(s) reflecting performance specification and the revision applicable to each CI effectivity range (block) or CSCI version ♦ Efficient, timely processing of ECPs and Requests for Deviation. ♦ Approved Class I ECP implementing actions scheduled and completed **Contractor(s)** ♦ Fully documented design and product configuration ♦ Verified as designed/as built configuration of each delivered CI and CSCI version including applicable and re-creatable documentation revisions ♦ Approved Deviations documenting all as-designed and as-built variances ♦ Traceability of Serial/lot numbered CIs and component parts ♦ Verified incorporation of approved ECPs into CI production effectivity; and validated retrofit kit deliveries to satisfy retrofit effectivity ♦ Reference to the correct configuration of support assets (support equipment, test program sets, trainers, manuals and associated software) required to maintain each operational configuration of each CI that is contractor supported.	♦ Checklist of actions to be completed prior to significant phase III events. **[See Table 2-4A.]** ♦ ECP Cycle time (may be stratified by $ value or complexity factors, ECP Priority codes and ECP Justification codes) **[See Phase II, Table 2-3B for metric operational definition of metric.]** ♦ Rate of Class I ECP Approval **[See Phase II, Table 2-3C for operational definition of metric.]** • Contractor CCB • Government CCB ♦ Number of Deviation Requests & % Recurring **[See Phase II, Table 2-3D for operational definition of metric.]** ♦ Number of Configuration Audits planned, held, successfully completed (all actions); Open actions remaining per audit. **[See Phase II, Table 2-3E for operational definition of metric.]** ♦ Volume of un-incorporated (unverified) engineering changes vs target (stratified by class and CI). **[See Table 2-4B for operational definition of metric.]** ♦ Number of approved ECP implementing actions completed vs schedule (stratified by type, priority, and responsibility). **[See Table 2-4C for operational definition of metric.]**

Table 2-4. CM Template for Phase III, Production, Fielding/ Deployment and Operational Support, Continued

ACTIVITY: Management and Planning, Phase III			
Actions:	**Ref:**	**Decisions/Criteria**	**Benefits/Risks**
Government ♦ Prepare, coordinate and release procedures implementing Phase III Government CM Process; conduct training. (See Govt configuration identification, control, status accounting, and audit activities below.) ♦ Measure/Evaluate Contractor CM Process	2.3.2 2.3.3, 3.1.2,	♦ Table 3-1. Config. Ident. Process Eval. Checklist ♦ Table 4-1. Config. Ctrl. Process Eval. Checklist ♦ Table 5-2. CSA Process Eval. Checklist ♦ Table A-2 Govt CM Plan	♦ **Benefit:** - The appropriate level of resources and the right information to efficiently and effectively conduct CM throughout Phase III ♦ **Risks, if not done:** – Inadequate resources to accomplish essential tasks late in program – Poor supportability at a time of aging assets
Contractor and Government ♦ Update CM Planning, as required, to reflect process improvements, new deployment information, changes in support/maintenance planning, major modifications, etc. ♦ Plan for end of production, demilitarization and disposal.	2.2.3, 2.3.1 - 2.3.4 Appx A, 5.2, 5.3, Sect. 7	♦ Table A-3 Contractor CMP ♦ Anticipate CM services required after production ♦ Consider CM information needs after production; upon demil/disposal • Is sustainment data sufficient? • Verify environmental constraints	
Contractor ♦ Prepare, coordinate and release procedures to implement the contractor CM Process for Phase III; conduct necessary training. (See contractor configuration identification, control, status accounting, and audit activities below.) ♦ Measure/evaluate sub-contractor CM Process	1.1, 1.3.1, 2.2.2, 2.2.3, EIA 649	♦ Tables 3-1, 4-1, 5-2 (See above)	

Table 2-4. CM Template for Phase III, Production, Fielding/ Deployment and Operational Support, Continued

ACTIVITY: Configuration Identification, Phase III			
Actions:	**Ref:**	**Decisions/Criteria**	**Benefits/Risks**
Government ♦ Perform basic Configuration Identification actions defined in Phase II, for documentation, hardware and software created or revised as a result of approved engineering changes. ♦ Where the Government is the design activity, authorize release of documents and document revisions ♦ Maintain current Functional baseline, and Government Allocated Baselines ♦ For CIs for which Government is configuration control authority at the detail design level, maintain a (Government) Product Baseline ♦ Assign Government Nomenclature, where appropriate **Contractor and Government** ♦ If maintenance plan is affected by a change, make sure that level of performance specification for the new configuration remains consistent with revised maintenance planning **Contractor** ♦ Perform basic Configuration Identification actions defined in Phase II, for documentation, hardware and software created or revised as a result of approved engineering changes, i.e., • Assign CI, document, part/item and software identifiers, • Revise interfaces using ICWGs/ICDs as applicable • Prepare and coordinate CI specification /revisions • Approve CI (PRF and/or DTL) specification/revision for CIs for which contractor has configuration control authority, establishing a new current (Contractor) Allocated Baseline • Track traceable items via serial number or lot number • Release engineering design data (Engineering drawings, computer models, software design documents) • Maintain design release (release record) • For CIs for which the contractor is configuration control authority for detail design, maintain (Contractor) Product Baseline	3.4.1, 3.4.2, 3.5.1, 3.5.2 3.2, 3.2.1, 3.3, 3.3.1, 3.3.2 3.6, 3.6.1-3.6.4 3.8, 3.8.1, 3.8.2 3.4, 3.4.1, 3.4.2 3.5, 3.5.1, 3.5.2 4.1.1.1 3.6.3 3.7, 3.7.1, 3.7.2 3..5, 3.5.1, 3.5.2, 4.1.1.1 6.1, 6.2, 6.2.1	♦ Table 3-2. CI Select. Crit. ♦ Fig. 3-3. Selection. of. Specification Types ♦ Table 3-3. Order of Precedence for Specs. ♦ Table 3-4. Spec.Types Categorized by Source ♦ Table 3-5. Spec. Types Categorized by Utility ♦ Table 3-6 Spec. Types Categorized by Object ♦ Table 3-7. Spec. Types Categorized by Purpose ♦ Table 3-13 Govt Acq. of Detailed design Data ♦ Table 3-11. Item Ident. ♦ Table 3-14. Doc. Defining Interfaces ♦ Table 3-15. Interface Mgmt. Process Matrix ♦ Fig. 3-6. Interface Mgmt. Process Flow	♦ **Benefit:** – Performance, interface and other attributes are clearly documented and used as basis for configuration control – Items are appropriately identified and marked – Re-identification occurs as significant changes are incorporated – Release controls and configuration baselines are maintained – Users and maintenance personnel can locate information correlated to correct product versions ♦ **Risks, if not done:** – Inability to provide efficient product support after production and deployment – Inadequate or incorrect product identification and marking resulting in incorrect replacement parts – Inability to distinguish between product versions resulting in deployment of assets requiring excessive support capability and assets without the functional capability needed for assigned missions – Inadequate basis for defining changes and corrective actions – Uncertain, wasteful and costly configuration control decisions

Table 2-4. CM Template for Phase III, Production, Fielding/ Deployment and Operational Support, Continued

ACTIVITY: Configuration Control, Phase III			
Actions:	**Ref:**	**Decisions/Criteria**	**Benefits/Risks**
Government			
♦ Establish Government configuration control procedures for phase III, including change Initiation and CCB operating procedures for change evaluation and disposition.	4.1, 4.1.1, 4.1.1.1-4.1.1.4	♦ Fig. 4-1. Config. Control Process Activity Model ♦ Fig. 4-2. Govt. ~ Change Initiation Activity Model ♦ Fig. 4-4. Govt. ~ Change Eval. & Disposition Activity Model	♦ **Benefits:** – Efficient change processing & orderly communication of change information – Change decisions based on knowledge of change impact – Changes limited to those necessary or beneficial – Evaluation of cost, savings and tradeoffs facilitated – Consistency between product and documentation – Configuration control preserved at system interfaces – Current baselines enable supportability – Deviations are documented and limited
♦ Evaluate contractor configuration control process	4.1.2	♦ Table 4-1. Config Control Process Eval. Checklist	
♦ Identify need for changes requested by Government activities, and when necessary or beneficial to the Government initiate requests for Class I ECPs; determine desired effectivity of requested change	4.1.1.1, 4.1.1.2, 4.2.1, 4.2.1.1 4.2.2	♦ Table 4-2. Change Classification ♦ Table 4-3. ECP Justification Codes ♦ Table 4-4. Class I ECP Types And Their Function	
♦ Coordinate, evaluate and disposition contractor's Class I ECPs with attached NORs, as applicable	4.1.1.4 4.2.1.4, 4.4	♦ Table 4-5. ECP Priorities ♦ Table 4-6. ECP Content ♦ Table 4-10, NOR Content ♦ Table 4-7. ECP Review and Disposition Actions	
♦ Direct contractual implementation of approved ECPs, in accordance with the approved effectivity, into configuration documentation, System, CIs, and all supporting commodities and services that are effected by the ECP	4.2.1.5	♦ Table 4-8. ECP Implementing Actions	
♦ Review and approve or disapprove contractor requests for deviation from Government approved configuration documents	4.3, 4.3.1, 4.3.2	♦ Table 4-9. RFD Content	♦ **Risks, if not done:** – Chaotic, ad-hoc change management – Changes approved without knowledge of significant impacts – Changes that are not necessary or offer no benefit – Lack of confidence in accurate cost, schedule estimates – No assurance of product to document consistency – Uncertainty at system interfaces – Inconsistent basis for supportability – No control of deviations – Ineffective Program
♦ Document local engineering changes and assure that they do not impact current baselines, prior to approving their implementation. Request contractor review when necessary.	4.1.1, 4.1.1.1		
Government/Contractor			
♦ Communicate on status and content of changes and deviation requests contemplated and in process	4.1, 4.2.1.1,	♦ Appendix G	
Contractor			
♦ Establish Contractor configuration control process and procedures for phase III including change identification, change evaluation and coordination and approved change implementation and verification	4.1, 4.1.1	♦ Fig. 4-1.Config. Control Process Activity Model Fig. 4-3. Contractor Config.Control Activity Model	

Table 2-4. CM Template for Phase III, Production, Fielding/ Deployment and Operational Support, Continued

ACTIVITY: Configuration Control, Phase III			
Actions:	**Ref:**	**Decisions/Criteria**	**Benefits/Risks**
♦ Evaluate sub-contractor configuration control process ♦ Process proposed changes to approved baseline configuration documentation: • Identify, classify and document change • Evaluate and coordinate change • Assess change impact • Determine proposed effectivity, schedule and cost • For proposed changes to the Functional Baseline, submit Class I ECPs • For proposed changes to an Allocated or Product Baseline - Where the Government is the configuration control authority, submit Class I ECPs with attached NORS, if applicable - Where the contractor is the configuration control authority, obtain a change approval decision from the appropriate organizational level with authority to commit resources to implement the change ♦ Plan change implementation ♦ Implement change and verify re-established consistency of product, documentation, operation and maintenance resources ♦ If necessary to depart temporarily from Government approved configuration documents, process and submit Requests for Deviation as required • Classify as major or minor • Document and submit to the configuration control process • Obtain approval decision from the appropriate authority – The Government if it is a major deviation to a Government approved configuration document – The DCMC (or other contractually designated authority) if is a minor deviation to a Government approved configuration document – The appropriate contractor internal authority if the deviation is to contractor baselined configuration documentation	4.1.2 4.1.1, 4.1.1.1 through 4.1.1.4 4.2, 4.2.1, 4.2.1.1 through 4.2.1.4 4.4, 4.4.1, 4.4.2 4.2.1.5 4.2.1.5 4.3, 4.3.1, 4.3.2	♦ Table 4-1. Configuration control Process Evaluation Checklist ♦ Table 4-2. Change Classification ♦ Table 4-3. ECP Justification Codes ♦ Table 4-4. Class I ECP Types And Their Function ♦ Table 4-5. ECP Priorities ♦ Table 4-6. ECP Content ♦ Table 4-10, NOR Content ♦ Table 4-7. ECP Review and Disposition Actions ♦ Table 4-8. ECP Implementing Actions ♦ Table 4-9. RFD Content	Management – Lack of confidence in both government and Contractor Process – Essentially, technical anarchy

Table 2-4. CM Template for Phase III, Production, Fielding/ Deployment and Operational Support, Continued

ACTIVITY: Configuration Status Accounting, Phase III			
Actions:	**Ref:**	**Decisions/Criteria**	**Benefits/Risks**
Government ♦ Establish procedures and screens for interacting with the Government CM AIS ♦ Test and assure the integrity of the configuration information in the Government data base(s); verify that CM business rules have been correctly applied ♦ Evaluate Contractor CSA Process **Government/Contractor (Based on contractual division of responsibility)** ♦ Identify the current approved configuration documentation and configuration identifiers associated with each System/CI(s). ♦ Identify the digital data file(s) and document representations of all revisions/versions of each document and software delivered, or made accessible electronically, in support of the contract. ♦ Record and report the results of configuration audits to include the status and final disposition of identified discrepancies and action items ♦ Record and report the status of proposed engineering changes from initiation to final approval to contractual implementation ♦ Record and report the status of all critical and major requests for deviation that affect the configuration of a system/CI(s). ♦ Report the effectivity and installation status of configuration changes to all system/CI(s) ♦ Provide the traceability of all changes from the original released configuration documentation of each System/CI(s) ♦ Record and report configuration changes resulting from retrofit and by replacements through maintenance action ♦ Retain information about: – Product configuration status – Configuration documentation – Current baselines – Historic baselines – Change requests – Change proposals – Change notices – Deviations – Warranty data/history – Configuration verification and audit status/action item close-out	5.1, 5.2, 5.3 5.3 5.2, 5.3	♦ Table 5-1. Typical CSA Information Over the Life Cycle ♦ Table 5-3. CSA Tasks ♦ Table 5-2. CSA Process Evaluation Checklist ♦ Table 5-3. CSA Tasks ♦ Table 5-4. Tailoring of MIL-STD-2549 Information Packets	♦ **Benefit:** – Correct, timely configuration information, when needed to facilitate decision making on changes, deployment of assets, determining applicable replacements, performing updates/upgrades. ♦ **Risk, if not done** – The risk of inadequate status accounting may result in improper decisions about change effectivity, retrofit requirements, deployment of items requiring support assets that are not in place; all of which contribute to avoidable cost.

Table 2-4. CM Template for Phase III, Production, Fielding/ Deployment and Operational Support, Continued

ACTIVITY: Configuration Status Accounting, Phase III			
Actions:	**Ref:**	**Decisions/Criteria**	**Benefits/Risks**
Contractor ♦ Evaluate Sub-contractor CSA Process	5.3	♦ Table 5-2. CSA Process Evaluation Checklist	

ACTIVITY: Configuration Audit, Phase III			
Actions:	**Ref:**	**Decisions/Criteria**	**Benefits/Risks**
Government ♦ Assign Audit co-chair for each audit ♦ Approve audit agenda(s) ♦ Approve minutes ♦ Certify contractors processes for Engineering Release, Configuration Control and Status accounting as adequate to maintain baseline control	6.1, 6.2, 6.2.1, 6.2.2, 6.2.2.1-6.2.2.3	♦ Table 6-1, Audit Planning and Pre-Audit Preparation ♦ Table 6-2 Conducting Configuration Audits ♦ Figure 6-3. Audit Certification Package Content	♦ **Benefit:** - Verified configuration and documentation consistent with operational and support requirements - Reliable and dependable baselines
Government/Contractor ♦ Conduct formal audit when required ♦ Review performance requirements, test plans, results, other evidence to determine product performs as specified, warranted & advertised ♦ Perform physical inspection of product and design information; assure accuracy, consistency & conformance with acceptable practice ♦ Record discrepancies; review to close out or determine action; record action items ♦ Track action items to closure via status accounting	6.3	♦ Table 6-2 Conducting Configuration Audits ♦ Figure 6-3. Audit Certification Package Content ♦ Table 6-3. Post Config. Audit Actions/Audit Close-out	♦ **Risk, of not doing:** - Unnecessary and avoidable support costs - Inaccurate technical manuals - Replacement parts that do not fit - Loss of confidence in supplier.
Contractor ♦ Verify product within normal course of process flow ♦ Assure consistency of release information and production/modification information ♦ Assign audit co-chair ♦ Prepare audit agendas ♦ Prepare audit minutes	6.2.1 6.3	♦ Fig. 6-2. Change Implementation and Verification ♦ Table 6-1, Audit Planning and Pre-Audit Preparation ♦ Table 6-2 Conducting Configuration Audits	

Table 2-4A. Operational Definition of Phase III Checklist of CM Actions Metric

Metric Title: Checklist of CM Actions Prior to Major Phase III Events		**Process Owner:** Government and Contractor CM Managers	
Description (including Data Source, Measurement Method, Frequency): Program unique checklist to be checked off as actions required prior to applicable events are completed. Actions listed should be consistent with CM planning and program schedules.		**Data Presentation:** See Checklist model below.	
Purpose/Desired Result: The purpose of this metric is to assure that the actions necessary to implement the CM process during the Production, Fielding/Deployment and Operational Support phase of the program are appropriately planned and completed per schedule.		**Linkage to Objectives:** This metric links to all Phase III CM objectives	
✓	**CONTRACTOR ACTIONS-CHECKLIST**	✓	**GOVERNMENT ACTIONS CHECKLIST**
	List CM Actions to be completed prior to: • First Production system or CI Delivery • First Delivery each new production block or lot • Release of each new software version • Retrofit kit delivery • Upon receipt of a CI for repair • Change to maintenance and repair procedures • End of subcontractor production • End of Contractor production • End of contractor operational support • Delivery of Technical Data Package *EXAMPLES ONLY*		List CM Actions to be completed prior to: • Acceptance of first production unit • Acceptance of all production units • First fielding/deployment • Major modification/overhaul • Retrofit Kit Acceptance • Fiscal year contract • Return of CI to supplier for repair • End of Production • Demilitarization and Disposal *EXAMPLES ONLY*

Table 2-4B Operational Definition of Change Incorporation Rate Metric

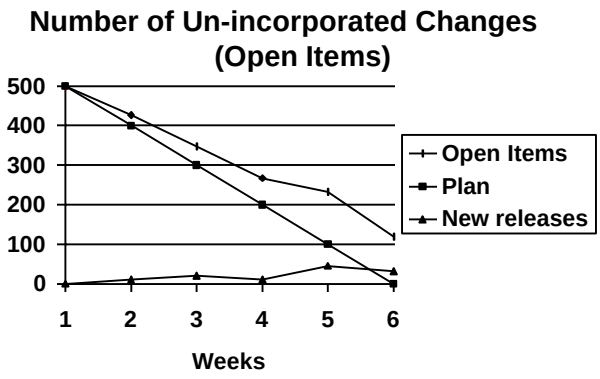
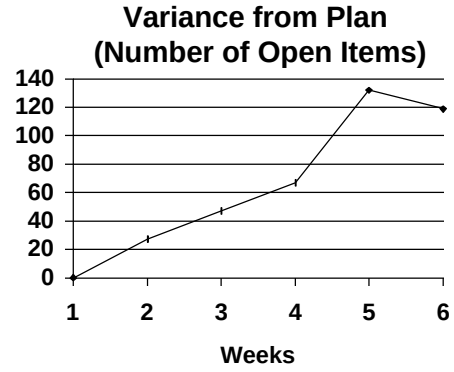
Metric Title: Change Incorporation Rate (Volume of Un-incorporated/unverified Engineering Changes)	**Process Owner:** Production Contractor or Government Rework Facility
Description (including Data Source, Measurement Method, Frequency): This metric measures the detailed change activity to be accomplished prior to delivery of each CI versus a predicted/expected rate of incorporation. It shows the rate of new changes being released and the rate that changes are being verified as completed. History compiled from successive deliveries is used to refine the slope of the expected rate. The source of information for this metric is the in-process as-designed vs as-built system used in production. Data are compiled from counts of the released but not verified changes over time. Typically data are plotted weekly. This metric may be stratified by CI, Class and responsibility for incorporation.	**Data Presentation:**  
Purpose/Desired Result: The purpose of this metric is to assess the readiness for delivery of each production CI. This metric is used most often where there is significant configuration change between successive CIs being produced or being prepared (refurbished) for delivery. The desired result from this metric is a predictable completion date and an early warning of possible delay due to rates of completion that are out of the expected range. Indirectly this metric provides an indication that incorporated changes are being verified and therefore the as-built configuration of the CI will be known.	**Linkage to Objectives:** This metric links to the Government objective of assurance that contractor(s) has established and is maintaining a Product Baseline for each CI and that there is a known configuration of all CIs in the operational inventory.

Table 2-4C Operational Definition of Class I ECP Implementing Action Metric

Metric Title: Completion of Class I ECP Implementing Actions	**Process Owner:** Government and Contractor CM managers
Description (including Data Source, Measurement Method, Frequency): This metric measures the specific post ECP actions* completed vs schedule (stratified by type and priority) for each approved Class I ECP and collectively for all Class I ECPs. It relates to both Government and contractor actions. Information for this metric comes initially from the ECP itself in the form of the commodities impacted by the ECP and the ECP implementation schedule. It is augmented by the detailed planning for ECP incorporation, and by the results of update of logistics plans. --- *(regarding Contracting, ordering, production incorporation, mod kit ordering, retrofit incorporation, support equipment, pubs update/delivery, spares, trainers and training, etc.)	**Data Presentation:** (Tabular) **a. Summary:** ---------- ACTIONS---------- **ECP. No.** **TOTAL** **DUE PER SCHED** **#DUE & OPEN** *4326* *14* *10* *2* *7894* *6* *6* *2* *Total # of ECPs =2* *20* *16 (80%)* *4 (25%)* (Plot trend) **b. Detail List:** **ECP No.** **ACTION** **RESPONS** **SCHED** **STATUS** *4326* *(List by Commodity)* *Date* *Open or Date Completed* *CI* *SE* *Pubs* *etc.*
Purpose/Desired Result: The purpose of this metric is to focus attention on the many detailed actions that must be completed over time to completely implement an ECP in all areas that are impacted by the ECP. This metric reflects the degree of communication between Government and Contractor and also the extent of the team effort required to successfully manage the post ECP approval process. The data on actions relating to each ECP assure effective tracking of completion actions, while the collective data indicate trends that may be used to effect corrective or improvement action by the Government or contractors, as necessary. The desired result is that sufficient attention is afforded to this critical activity to ensure that the Governments configuration management objectives in support of the operational forces are effectively achieved.	**Linkage to Objectives:** This metric links to the following CM objectives: • Current Functional and Allocated Baseline(s) reflecting performance specification and the revision applicable to each CI effectivity range (block) or CSCI version • Known configuration of all CIs in operational inventory • Access to validated revision of operation and maintenance manuals for the current configuration of each deployed CI S/N or CSCI version; knowledge as to which revision incorporates each approved ECP that impacted the manual • Ability to determine the current mission capability of each CI S/N reflected by installed software version, ECP (& modification kit) incorporation, and local insertion of mission data. • Known configuration, (quantities and location) of spare and replacement parts to maintain current configuration; and modification kits to upgrade to new (baseline) configuration • Access to design disclosure data for spare parts to be re-procured to detailed design rather than performance data. • Verified incorporation of approved ECPs in prescribed CI production effectivity; validated retrofit kit deliveries for retrofit effectivity.

SECTION 3
CONFIGURATION IDENTIFICATION

	QUESTIONS THIS SECTION WILL ANSWER	Para.
1.	What is the configuration identification process and why is it necessary?	3.1
2.	What are the performance attributes of the configuration identification process?	3.1.1, 3.1.2
3.	What inputs provide the information needed to make intelligent configuration identification decisions?	3.1
4.	What is a Product Structure; how is it determined and used?	3.2
5.	What are configuration items? Does the Government establish a baseline for all configuration items?	3.3, 3.3.1, 3.3.2
6.	What documents should the Government be concerned about? Which should be left to contractor discretion?	3.4
7.	How does the Government select the appropriate document type to specify performance? How does the contractor?	3.4.1, 3.4.2
8.	How shall Performance Specifications be used? What are the different types of performance specifications?	3.4.2
9.	What is a Detail Specification and when may it be used?	3.4.2
10.	What visibility into the contractorš design solution does the Government need?	3.4.3, 3.4.4
11.	How do we determine what baselines should be established?	3.5
12.	How many levels of baselining are necessary? How do they evolve over the life cycle?	3.5.1, 3.5.2
13.	How should documents be identified?	3.6, 3.6.1, 3.6.2
14.	How should items be physically identified? To what level does the Government need discrete identifiers?	3.6.3, 3.6.4
15.	What is the engineering release process? Why is it important?	3.7, 3.7.1
16.	How does the Government determine the appropriate level of detailed design data to acquire?	3.72
17.	What data content and functional capability should be expected from an engineering release process?	3.7.2
18.	How are external and internal interfaces defined?	3.8
19.	What is the relationship of interface control documents/drawings to configuration documentation?	3.8.1, 3.8.2
20.	How involved should the Government be in the management of interfaces?	3.8.1, 3.8.2

3.1 Configuration Identification Activity

Configuration identification incrementally establishes and maintains the definitive current basis for control and status accounting of a system and its configuration items (CIs) throughout their life cycle (development, production, deployment and operational support, until de-militarization and disposal). The configuration identification process ensures that all acquisition and sustainment management disciplines have common sets of documentation as the basis for developing a new system, modifying an existing component; buying a product for operational use, and providing support for the system and its components. The configuration identification process also includes identifiers that are shorthand references to items and their documentation. Good configuration control procedures **[Section 4]** assure the continuous integrity of the configuration identification. The configuration identification process includes:

- Selecting configuration items at appropriate levels of the product structure to facilitate the documentation, control and support of the items and their documentation
- Determining the types of configuration documentation required for each CI to define its performance, functional and physical attributes, including internal and external interfaces. Configuration documentation provides the basis to develop and procure software/parts/material, fabricate and assemble parts, inspect and test items, and maintain systems
- Determining the appropriate configuration control authority for each configuration document consistent with logistic support planning for the associated CI

- Issuing identifiers for the CIs and the configuration documentation
- Maintaining the configuration identification of CIs to facilitate effective logistics support of items in service
- Releasing configuration documentation; and
- Establishing configuration baselines for the configuration control of CIs.

Effective configuration identification is a pre-requisite for the other configuration management activities (configuration control, status accounting, audit), which all use the products of configuration identification. If CIs and their associated configuration documentation are not properly identified, it is impossible to control the changes to the items' configuration, to establish accurate records and reports, or to validate the configuration through audit. Inaccurate or incomplete configuration documentation may result in defective products, schedule delays, and higher maintenance costs after delivery.

Figure 3-1 is an activity model of the configuration identification process. It is a more detailed view of a portion of the configuration management activity model described in Section 2. **[Reference: Figure 2-1]** It highlights the relationships between the elements of configuration identification, discussed in the following paragraphs. As in the previous activity model, the boxes represent activities. The arrows entering at the left of each box are inputs. Those entering from the top are constraints. Those entering at the bottom are facilitators or mechanisms. The arrows leaving each box from the right are outputs.

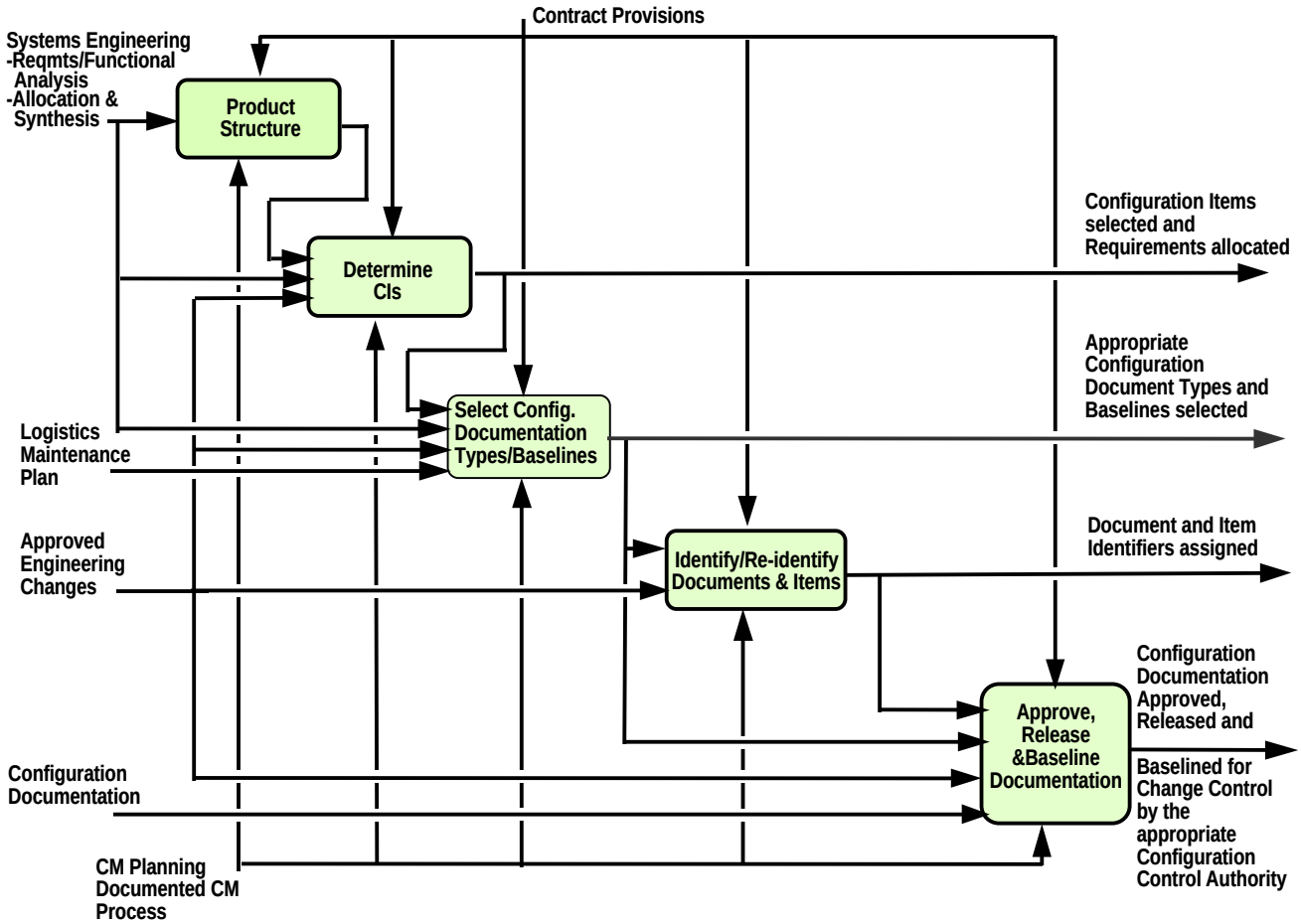


Figure 3-1. Configuration Identification Process Activity Model

3.1.1 Configuration Identification General Concepts and Principles

The basic principles of configuration identification are articulated in EIA Standard 649. It cites the following purposes and benefits of configuration identification:

- Determines the structure (hierarchy) of a product and the organization and relationships of its configuration documentation and other product information
- Documents the performance, interface, and other attributes of a product
- Determines the appropriate level of identification marking of product and documentation
- Provides unique identity to a product or to a component part of a product
- Provides unique identity to the technical documents describing a product
- Modifies identification of product and documents to reflect incorporation of major changes
- Maintains release control of documents for baseline management
- Enables a user or a service person to distinguish between product versions
- Enables a user or a service person to correlate a product to related user or maintenance instructions
- Facilitates management of information including that in digital format (See 5.6.)
- Correlates individual product units to warranties and service life obligations
- Enables correlation of document revision level to product version/configuration
- Provides a reference point for defining changes and corrective actions.

The basic principles guide effective configuration identification practices by both Government and industry. They are independent of specific methods of acquisition practice. A particular method of acquisition practice, such as "Performance based acquisition," influences the types of Government controlled documents selected to define systems or configuration items and the delegation of responsibilities for approving changes to specifications and detailed design documentation. It also offers contractors flexibility in choosing the methods of design definition. However, it does not alter the necessity for both Government (the acquiring activity) and Contractors (the performing activity) to implement practices that employ the basic configuration identification principles.

The single process initiative enables a contractor to employ a common set of practices to all products and services they provide to the Government from a given facility. The Government's contractual requirements must respect the contractors common process in order to realize significant acquisition cost savings. A "block change methodology" may be employed to transition from individual contract-based processes to a common set of practices. The Government's configuration identification practices should be applied only at the level at which items are designated as configuration items **[Detail 3.2.1 and 3.3]** and at which Government approved performance or detail specifications are written. Contractor practices, meeting the principles of EIA-649, should be applied to commercial items used in Government systems, to CIs whose performance requirements are allocated, approved, and controlled only by the contractor, and to items below the CI level that are within the contractor's design cognizance.

3.1.2 Configuration Identification General Activity Guides

Acquisition reform and the single process initiative will not result in overall life cycle savings to the Government if contractor configuration identification practices result in products that cannot be adequately operated and maintained during the operational support period. Identification practices that do not conform to the basic CM principles cannot be relied on to assure that end items will have the interchangeability of functionality and performance indicated by their CI identifiers.

It is therefore essential that contractor process adherence to the basic principles be evaluated as part of the source selection process. A configuration identification process evaluation checklist, **Table 3-1**, is provided to assist in this process. Since individual contract surveillance is counter to common process implementation, such means as capability assessments, past performance and DCMC interaction are the preferred methods for this evaluation. Appropriate metrics and periodic assessments of contractor performance in conforming to documented and approved processes are also necessary. However, where a common process is employed, the Government should avoid redundant reviews on a contract by contract basis.

Activity Guide: Table 3-1. Configuration Identification Process Evaluation Checklist

✓	Items to Review
	1. Documented Process
	a. Does the contractor have a documented Configuration Identification process?
	b. Does the contractor follow the documented process?
	c. Are contractor personnel from all disciplines and teams involved in the process informed and knowledgeable about the procedures they are supposed to follow?
	2. Product Structure
	a. Is the product (System/CIs) structured into a rational hierarchy?
	b. Are subordinate CIs identified at a reasonable level for: (1) Specification of and measurement of performance? (2) Management of the effectivity of changes? (3) Obtaining spare parts using performance or design documents?
	c. Can the composition of each System/CI be determined from the configuration documentation
	3. Configuration Documentation
	a. Does the contractor's configuration documentation define the performance, functional, interface, and physical attributes of each System/CI ?
	b. Do the performance requirements of the system and/or top level Configuration Item specifications meet or exceed threshold performance of the Acquisition Program Baseline?
	c. Are all configuration documents uniquely identified? (1) Does the identification reflect the source (CAGE code) of the preparing original design activity and current design activity, the type of document, and an alphanumeric identifier? (2) Can each document be easily associated with the CI configuration to which it relates and where applicable, the range of CI serial numbers to which it applies?
	4. Product Identification
	a. Are all Systems/CIs/CSCIs and subordinate parts down to the level of non-repairability assigned individual unique part/item identifiers?
	b. Do the assigned identifiers enable (1) Each part/item to be distinguished from all other parts/items? (2) Each configuration of an item to be distinguished from earlier and later configurations?
	c. Can the next higher assembly application of each part be determined from the design documentation (including associated lists/records)?
	d. Does the documentation indicate whether CIs are serialized (or lot controlled)?
	e. Is the common base identifier for serialization/lot numbering always a non-changing identifier?
	f. Is part/item effectivity to be defined in a manner appropriate for the product type?
	g. When an item is changed to a new configuration, is its identifier altered in both the configuration documentation and on the item itself to reflect the new configuration?
	h. When an existing item is modified, does it retain its original serial number or lot number even though its part/item identifier is changed?(Exception: does not apply to the modification of a partial lot or the consolidation of multiple lots.)
	i. Are CSCI versions identified and, if applicable, associated to the configuration of the item into which they are to be installed/loaded?
	5. Configuration Baselines
	a. Are appropriate configuration baselines established and maintained as a basis for configuration control?
	b. Are functional and/or allocated baselines established and maintained for Systems and CIs to be controlled by the Government?
	c. Are functional and/or allocated baselines established and maintained for Systems and CIs to be controlled by the contractor? By subcontractors?
	d. Is the current configuration baseline for the system and for each CI easily determinable?

Activity Guide: Table 3-1. Configuration Identification Process Evaluation Checklist

✓	Items to Review
	e. Is an adequate system of release control in place and used for the release of all configuration documents?
	(1) Can the as-released configuration of each CI be determined?
	(2) Can past configurations be determined? (Applies to both the engineering design configuration and the product configuration.)
	(3) Do release records reflect the authority for changing from one configuration to the next? Do they reference the ECP identifier and Contract Modification (where applicable)?
	(4) Does the release system prevent unauthorized changes to released documents?
	6. Interface Control
	a. For interfaces external to the contractor, are interface agreements established where necessary to document and agree to performance, functional and physical interfaces?
	b. Do CIs being developed by different contractors for the program have well defined interfaces?
	7. Metrics
	a. Are statistical records of document release and other measurable configuration identification actions maintained?
	b. Is the data reduced to meaningful measurement useful in maintaining and improving the process?

3.2 Product Structure

Product Structure, also referred to as system architecture, refers to the identifiers, internal structure, and relationship of system components and associated configuration documentation. Product structure, derived from the functional analysis and allocation process of system engineering, may be depicted graphically as a tree structure or as an indentured listing.

3.2.1 Product Structure Concepts

As a program matures through its early phases, the systems engineering process produces the optimized functional and physical composition of the system architecture to the level that it is necessary for the Government to specify and control item performance. This is the lowest level at which CIs are designated during the Engineering and Manufacturing Development Phase of the life cycle. Management tools such as specification and drawing trees, and work breakdown structures are all views of the product structure which are directly relatable at the CI level.

Program and contract work breakdown structures (WBS) are views of the product family tree structure showing the hardware, software, services, data, and facilities against which costs are collected. The WBS relates the elements of work to be accomplished to each other and to the end product. CIs are identified as work breakdown structure elements. Uniform element terminology, definition, and placement in the upper three levels of a WBS are common for many categories of defense materiel. The WBS is extended to lower levels by the DoD component and contractor(s).

Product structure activity guidance is included in **Table 3-1**, above..

3.3 Configuration Items

Selected items of system hardware or software (or combinations of hardware and software), in which the Government or acquiring activity has configuration management concern, are designated as Configuration Items (CIs).

3.3.1 Configuration Item Concepts

CIs are the basic units of configuration management. They may vary widely in complexity, size and type, from an aircraft, ship, tank, electronic system or software program to a test meter or a round of ammunition. Regardless of form, size or complexity, the configuration of a CI is documented and controlled. CI selection separates system components into identifiable subsets for the purpose of managing further development. For each CI:

- There will be associated configuration documentation (which may range from a performance specification to a detailed drawing to a commercial item description **[See 3.4.2]**
- Configuration changes will be controlled
- Configuration status accounting records will be maintained
- Configuration audits will be conducted to verify performance and product configuration (unless the CI has an already established product baseline).

To define and control the performance of a system or CI, does not mean that all of its hardware and software components must be designated as CIs, nor does it mean that the performance requirements for the non-CI components must be under Government control. The requirements to be met by a lower-level component (which is not designated as a CI) are established and controlled via the Contractor's design and engineering release process. Government control occurs only when changes to the lower level components impact the Government-baselined performance specification for the CI.

Initial CI selection should reflect an optimum management level during early acquisition. Initially, for Engineering and Manufacturing Development (Phase II), CIs usually are the deliverable, and separately installable units of the system and other items requiring, significant management attention at Buyer/Seller interfaces (i.e., Government/Prime Contractor, Prime Contractor/Subcontractor, etc.). During, Production, Fielding/Deployment and Operational Support (Phase III), individual items required for logistics support and designated for separate procurement are also CIs. As shown in **Figure 3-2,** the view of what is designated a CI may depend on where in the contracting tree the view originates. (Note that, where the Government acquires a system using detail, rather than performance specifications, the Government view may eventually include all of the CIs shown in this figure.)

Computer software items, because they typically control the functionality of a system, are almost always designated as CIs. The term CI encompasses both hardware and software; when a statement in this handbook applies only to hardware, or only to software, the terms HWCI and CSCI are used.

Typically the top tier of CIs directly relate to the line items of a contract and the work breakdown structure. The determination of the need to designate them as CIs is normally simple and straight forward. However, there are many cases in which other lower-level items should also be selected based on the management needs of the program. Some of the primary reasons for designating separate CIs are:

- Critical, new or modified design
- Independent end use functions
- Sub-assembly factors such as the need for separate configuration control or a separate address for the effectivity of changes **[Details: Section 4]**
- Components common to several systems
- Interface with other systems, equipment or software
- Level at which interchangeability must be maintained
- Separate delivery or installation requirement
- Separate definition of performance and test requirements.
- High risk and critical components

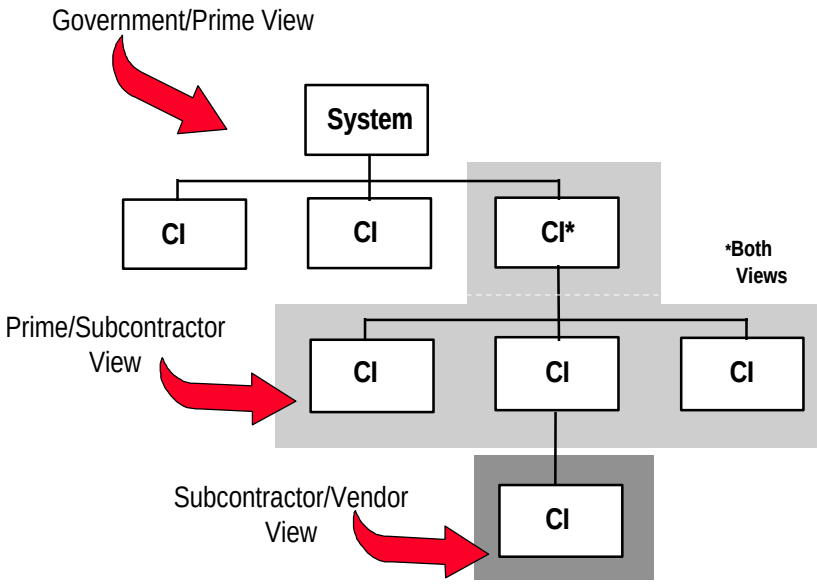


Figure 3-2. Tiering of CI Designations

Although the initial CI selection generally occurs early in the acquisition process, its consequences are lasting and affect many aspects of program management, systems engineering, acquisition logistics, and configuration management. CI selection establishes the level of Government configuration control throughout the system life cycle. Selecting CIs separates a system into individually identified components for the purpose of managing their development and support. Government CI designation should reflect the optimum level for both acquisition and support. During acquisition, this is the level at which a contracting activity specifies, contracts for, and accepts individual components of a system, and at which the logistics activities organize, assign responsibility and report modification and maintenance actions during support.

During the concept exploration and the program definition and risk reduction phases, the system architecture is established, the program work breakdown structure is developed, and major CIs are selected. These activities provide the basis for the Supportability Plan for the program, which, in turn, dictates the selection of lower-level CIs. Development, acquisition, retrofit, and hardware and software interfaces are all affected by the breakout of the key system elements into CIs during the early stages of the development effort.
[Details 3.3.2; Activity Guide: Table 3-2. Configuration Item Selection Criteria]

3.3.2 Configuration Item Activity Guides

Many engineering requirements or considerations can influence the selection of CIs. Throughout development and support, the allocation of engineering effort and organization are rooted in the selection of CIs. Developing contractors should participate in the selection process and provide recommendations based upon engineering or other technical considerations.

Selection of CIs is an iterative process occurring during the period from the PD&RR phase through production. Either the Government or the contractor may make initial recommendations of top-level CI candidates as a result of their system engineering analyses; however the contractor is normally tasked to provide the comprehensive recommendations. CI selection criteria are applied to contractor recommendations to decide on the items to be managed as CIs by the Government. Decisions to designate specific candidates as CIs and decisions on the time when they will come under Government control normally involve an integrated team of acquisition program management, systems engineering, and acquisition logistics working with configuration management. In addition, the contractor determines those items in the system that are not Government CIs, but which will be subject to lower tier lower tier configuration management by the contractor.

Activity Guide: Table 3-2. Configuration Item Selection Criteria

	The process of selecting configuration items requires the exercise of good systems engineering judgment based on experience, supported by cost trade-off considerations. No fixed rules govern CI selection or dictate the optimum number of CIs for a particular system. Rather guidelines for making the appropriate judgments are provided in the General Guidance, CI Selection Checklist, and Additional Factors sections of this table.
General Guidance:	
1.	Designating a system component as a CI increases visibility and management control throughout the development and support phases. For system critical or high technical risk components, added visibility can help in meeting specified requirements and maintaining schedules.
2.	For each development contract, there should be at least one CI designated.
3.	For complex systems, major functional design components are usually designated as CIs. The initial selection is normally limited to the major component level of the work breakdown structure.
4.	As system design evolves during development and complex items are further subdivided into their components, additional CIs may be identified. Developing contractors should be given maximum latitude to design below the system level. Changing system architecture or the reallocation of functions after a baseline has been established by the Government should be avoided
5.	Each CI should represent a separable entity that implements at least one end use function.
6.	The selection of CIs should reflect a high degree of independence among the CIs at the same level. Subordinate components a CI, which are recommended as CIs during the detail design process, should all be functionally interrelated.
7.	Operational software should always be differentiated from support software by designating each as a separate CI.
8.	The complexity of CI interfaces in a system should be minimized. Complexity often results in increased risk and cost.
9.	All subassemblies of a CI should have common mission, installation and deployment requirements.
10.	For systems with common components, subsystems, or support equipment, each common item should be separately designated as a CI at an assembly level common to both systems.
11.	A unique component that is peculiar to only one of multiple similar systems should be identified as a separate CI of that system.
12.	Off-the-shelf privately developed items generally should not be designated as CIs. However, commercially available items that have been modified at Government expense should not necessarily be excluded from CI selection. (Factors to consider include: the extent of the modification; the criticality of the modified CI to the mission of the system; and the extent of ownership, data rights, and configuration documentation required and available to the Government.)
13.	Generally, any NDI designated for logistic support by Government personnel should be designated as a CI. In such cases, the Government must acquire sufficient configuration documentation to enable the support..
CI Selection Checklist	
If most of the answers to the following questions are "yes," the item should be considered for designation as a separate CI. If most answers are "no," it probably should not be designated as a CI. However a single over-riding 'yes" may be sufficient to require an item to be separately identified as a CI.	
1.	Is the item's schedule critical or high risk? Would failure of the item have significant financial impact?
2.	Does the item implement critical capabilities (e.g., security protection, collision avoidance, human safety, nuclear safety)? Would CI designation enhance the required level of control and verification of these capabilities?.
3.	Will the item require development of a new design or a significant modification to an existing design?
4.	Is the item computer hardware or software?
5.	Does the item incorporate unproven technologies?
6.	Does the item have an interface with a CI developed under another contract?
7.	Can the item be readily marked to identify it as a separate, controlled item?
8.	Does the item interface with a CI controlled by another design activity?
9.	Will it be necessary to have an accurate record of the item's exact configuration and the status of changes to it during its life cycle?
10.	Can (or must) the item be independently tested?
11.	Is the item required for logistic support?
12.	Is it, or does it have the potential to be designated for separate procurement?
13.	Have different activities have been identified to logistically support various parts of the system?

Activity Guide: Table 3-2. Configuration Item Selection Criteria

14. Is the item at an appropriate level for Government configuration control?
15. Does the item have separate mission, training, test, maintenance and support functions, or require separately designated versions for such purposes?
16. Do all subassemblies of the item have common mission, installation and deployment requirements, common testing and Government acceptance?
Additional Factors
1. Many development and support planning milestones are related to CIs. Activities such as performance or design verification demonstration, system integration and testing, technical reviews and audits, and budget allocations are usually accomplished for each of the CIs selected. The number of CIs selected will determine the number of separate meetings related to the overall activity. A large number of CIs may lead to delays in completing critical milestones.
2. Existing CIs (available from the Government inventory) may be modified and designated as a separate and different configuration of that CI, thus saving time and money. Factors to be traded off include complexity, the use of new materials, processes, and the insertion of new technology.
3. There are no rules to dictate the optimum number of CIs for a given system. In general, however, the fewer CIs, the better. Selecting too many CIs increases development and support costs.
4. Each CI to be developed, especially CSCIs, comes with an associated set of technical reviews, audits, performance or design verification demonstrations, formal unit and integration tests, and documentation requirements. Each of these activities adds an increment of development cost and also adds costs for storage and upkeep of information related to the activities and the documentation.
5. The consequences of designating too many CIs include: • Numerous inter-CI interfaces to be defined, and documented, which, if they are all baselined by the Government early in the EMD phase, will inhibit the contractor's freedom to evolve his design solution, solve problems expeditiously, and implement advantageous changes without contractual consequences. • CI functionality defined at too low a level or including unnecessary design constraints requiring formal test, and technical reviews, beyond what is required for the Government to achieve reasonable assurance of system performance. (This is also a concern if performance specifications for the lower-level CIs are baselined too early in the EMD phase.) • Increased overall number of requirements in the documentation disproportionate to the unique technical content of the requirements • Excessive fragmentation, which may actually decrease Government visibility and understanding of system performance. Fragmented description of functionality increases the overall volume of requirements, is more difficult to understand, and complicates the document review, approval, and control process. • Increased Cost
6. The consequences of having too few CIs include: • Increased complexity of each CI resulting in decreasing management insight and ability to assess progress • Where the lowest level designated CI is a complex item (implementing unrelated functions, containing both hardware and software components, etc.): The potential for reuse of the CI, or portions of the CI is diminished Re-procurement of the CI and components is complicated Potential re-procurement sources are limited.. Formal testing of critical capabilities may be delayed or made more difficult. The inability to account for the deployment of a CI, whose component parts are disbursed to different locations Difficulty in addressing the effectivity of changes and retrofit actions, particularly when there are different quantities or separately deliverable components Increased complexity in managing and accounting for common assemblies and components

3.4 Configuration Documentation

The term configuration documentation characterizes the information that defines the performance, functional and physical attributes of a product. As described in EIA Standard 649, all other product documentation (such as operation and maintenance manuals, illustrated parts breakdowns, test plans and procedures) are based on and relate to information in the configuration documentation. The configuration documentation associated with each CI provides the basis for configuration control **[See Section 4]**, logistics support, post-deployment software support, and re-procurement.

Acquisition reform has made a significant change in the types of configuration documents used to specify configuration items and on the baselining and configuration control of configuration documentation. Since the Government now specifies performance and, in most cases, leaves design solutions to the contractor, the Government determines the system product structure level at which to specify, baseline and control item performance and the specification type to be used. Below this level the contractor chooses the types of documentation to use. **[Details 3.4.1 through 3.4.4]**

3.4.1 Specification Concepts

The selection of the appropriate specification document types is dependent upon a number of factors such as the maturity of the item, and the context and environment in which it must operate. The new order of precedence defined by DoD policy strongly indicates preference for the use of existing commercial products, wherever possible, and the choice of products meeting Performance rather than Detail Specifications. **[Details: 3.4.2, Activity Guide: Table 3-3.]**

Program Unique Specifications, of both a performance and detailed nature, are at the bottom of the preference hierarchy and are used when the other choices are not available or applicable. Nonetheless, acquisition programs dealing with the development of new systems will continue to see the use of program unique specifications where the specifications are being prepared for a single system or item and have little potential for future use except for repetitive fiscal year production and spares purchases. Both the Government and contractors should seize opportunities at lower levels of the specification tree (where developed items, referred to as non-developmental items (NDI) may be used) to select higher preference specification types, and to specify only performance and interface requirements rather than design solutions in those specifications, whenever possible. To aid in understanding the array of various designations used to identify specifications, **Figure 3-3**, categorizes the specification document types, as follows:

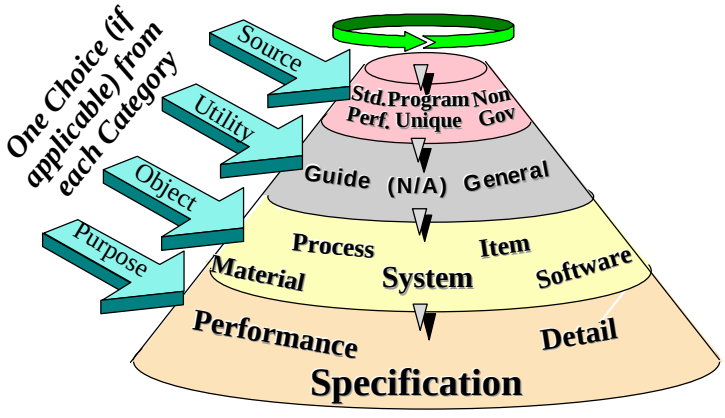


Figure 3-3. Selection of Specification Types

- **Source** (Non-Government, Commercial, Federal, Military, Program Unique) - category indicates the standardization/specification domain of the document; **[Detail: Activity Guide: Table 3-4]**
- **Utility** (General, Generic or Guide) if applicable- relates to the characteristic of the documents that facilitates standardization by providing "boilerplate" or templates for classes of items with largely common requirements. This category applies only to those documents where these characteristics are applicable. **[Detail: Activity Guide: Table 3-5]**
- **Object** (System, Item, Software, Material, Process) - represents the type of CI object in MIL-STD-961D, Appendix A that a specification is intended to define. The objects are not restricted to use with program unique specifications; they are applicable for use with the other source categories as well. They replace the MIL-STD-490 categories, e.g., prime item, critical item, inventory item, etc. **[Detail: Activity Guide: Table 3-6]**
- **Purpose** (Performance or Detail) - distinguish between performance and detail specifications. Their content and format are delineated in MIL-STD-961D. Performance specifications define requirements and constraints for a system or CIs entering the engineering and manufacturing development phase or being acquired at a performance level. Detail specifications define requirements and a specific design for CIs being acquired during a production, deployment and operational support phase. **[Detail: Activity Guide: Table 3-7]**

3.4.2 Specification Activity Guides

The activity guides for Specifications, **Tables 3-3 through 3-7** follow.

Activity Guide: Table 3-3. Order of Preference for Specifications

Order	Type of Document	Defined By	Use
I	**Specific Defined Documents**		
	• Various	Law, or regulation pursuant to law	When mandated
II	**Performance Documents (Not Program Unique)**		
	• Non-Government Standards	Industry Associations and Societies (e.g., ASME, ASTM, SAE, EIA)	When they contain only performance-based requirements sufficient for the intended acquisition
	• Commercial Item Descriptions		Commercially available item, performance description of which has been standardized
	• Federal Specifications		When an applicable Federal Specification (applicable for use by all agencies and departments) is available
	Standard (General) Performance Specification (MIL-PRF-XXXXX)	MIL-STD-961D	**(See Note 1)**
III	**Detail Documents**		
	• Non-Government Standard	Industry Associations and Societies	**(See Notes 2 and 3)**
	• Federal Specification		**(See Notes 2 and 3)**
	Standard (General) Detail Specification (MIL-DTL-XXXXX)	MIL-STD-961D	**(See Notes 1, 2, and 3)**
IV	**Government Non-MIL, Non-Fed Standard/Specification**		
	• Purchase Description • Product Description • Specification	Multiple sources, various Government agencies	When a suitable, existing, document can be found

Activity Guide: Table 3-3. Order of Preference for Specifications

Order	Type of Document	Defined By	Use
V	**Program Unique Specifications: Performance (PRF)/Detail (DTL)**		**(Notes 2, 3, 4 and 5 apply to all items below.)**
	• System Specification (PRF only)	MIL-STD-961D, Appendix A	When performance of system is specified.
	• Item Specification	MIL-STD-961D, Appendix A	To document the performance or detail requirements of a CI, when an item is being acquired by the Government or by a Contractor **(See Note 6.)**
	• Software Specification **[Also see Table 3-9 Activity Guide, Software documentation]**	MIL-STD-961D, Appendix A and EIA/IS-640/ IEEE P1498, ISO/IEC 12207	Performance: When requirements are specified for development or delivery of software Detail: When software design, interface and data base descriptions are specified either in Appendices, or by reference, as the basis for delivery of software. **(See Note 6.)**
	• Material Specification	MIL-STD-961D, Appendix A	When a specific material, for which there is no existing standard, must be specified as part of the design solution by a contractor. **(See Note 7.)**
	• Process Specification	MIL-STD-961D, Appendix A	When a unique manufacturing, test method, or inspection process must be specified as part of the contractor's design solution. **(See Note 7.)**
VI	**(Legacy) MIL, FED or Program Unique Specifications**		
	• Various types	MIL-STD-490, etc.	Only for re-procurement of items not requiring major modification or upgrade or when a non-DoD customer or lead agency from another country requires it.

NOTES:

1. When the requirements can be cited using a General Specification, specification sheet, or MS sheet.
2. A Detail Specification is used when requirements for interface definition, safety, adequacy or interchangeability make specification of materials, design or construction requirements, or "how-to" information necessary.
3. Use of a Federal or Military Detail Specification by the Government requires a waiver granted by the applicable authority for the program's acquisition category (See DoD 5000.2-R and DoD Policy Memo 95-1) unless one or more of the following applies:
   - It is for re-procurement of an item not requiring major modification or upgrade
   - The contractor proposes its use in response to a solicitation
   - The acquisition is for Federal Supply Group 11 (Nuclear Ordnance) or Federal Supply Class 4470 (Nuclear Reactors)
   - It is required by a non-DoD customer or lead agency from another country in a joint acquisition
   - It is cited for guidance only
4. A Performance Specification is changed into a Detail Specification by addition of design requirements (design constraints, design solution) beyond the minimum required for interface and interchangeability.
5. A Program Unique Specification is used:
   - When there are no alternative higher precedence documents available
   - For a specific program or part of a single system (including repetitive fiscal year production and spares purchases), and
   - If there is little potential for future use by subsequently developed systems.
6. MIL-STD-961 recommends that Program Unique Item and Software Specifications be prepared as unified specifications containing all applicable performance and design requirements in a single document as opposed to separate development (or requirements) and product specifications.
7. DoD discourages use of military unique material and process; commercial materials and methods shall be used wherever possible. (Ref: Policy Memo 95-6.)

Activity Guide: Table 3-4. Specification Types Categorized by Source

This table describes various standardization and specification domains in which a specification may originate. This category is part of a string comprising the specification type. ***[See Fig. 3-3]***

Source	Description
Non-Government	Standards or specifications published by industry associations or societies recognized as standards making bodies by the American National Standards Institute (ANSI), which define minimum acceptable performance and quality, or precise interface requirements for a category of product. Examples of non-Government associations are ASME, SAE, EIA; example of performance/quality standard is SAE 30 Motor Oil; examples of standard interfaces are electronic connectors, screw thread sizes.
Commercial	Commercial Item Descriptions (CID) are standard purchase descriptions that by definition, are performance-based because they facilitate competitive bid for products meeting a stated functional requirement. Also commercial product descriptions (such as a manufacturer's catalog or specification sheet) and commercial purchase descriptions (item descriptions to be spelled out directly in a purchase order) qualify under this category.
Federal	Standards or specifications applicable to all agencies of the federal Government for items widely used. (They may be either performance or detail based)
Military	Specifications prepared for standard items with use in many different applications in weapons systems and their support equipment. These specifications are intended mainly for the competitive procurements of identical items for use as spares and for use in new weapons systems. Military Specifications are prepared in accordance with MIL-STD-961 and are listed in the DoD Index of Specifications and Standards (DODISS). They are subject to the requirements of the Defense Standardization Program.
Standard Performance	Standard Performance Specifications (MIL-PRF) are performance specifications for items common to a number of different systems and subsystems. They follow the same guidelines as other performance specifications (see category b. below). They differ from Military specifications in that they may be satisfied by different, perhaps competing products that are not identical but meet the same form fit and function requirements.
Program Unique	Specifications for a system, item, software, process or material, unique to a specific acquisition program, prepared by either Government or Contractor to define and baseline requirements for development, production (including repetitive fiscal year production and spares purchases), support and re-procurement. Program unique specification format and content, previously defined in MIL-STD-490, which is canceled, are defined in MIL-STD-961D, Appendix A, with considerably more flexibility.

Activity Guide: Table 3-5. Specification Types Categorized by Utility

This table describes a category of specifications that facilitate standardization by providing "boilerplate" or templates for classes of items with largely common requirements. This category applies only to those documents where these characteristics are applicable. This category is part of a set of categories which comprise the specification type. ***[See Fig. 3-3]***

Utility	Description
General, Associated, and Specification Sheets	A general specification is one which facilitates the preparation of specifications for a number of items that are common except for specific variables such as size, power, range, etc. The General Specification defines the common requirements; the specific variables of each item are defined in either associated specifications or specification sheets. Associated specifications are used when the variables require a number of pages of specification language to define. Specification sheets are used when the variables can be numerically tabulated. Both are linked by specification number to the related general specification. Typically the associated specification, or specification sheet is identified by the general specification number followed by a slash and a serially assigned identifier. (Example: MIL-PRF-18/25) Where there is ambiguity (conflict) between the General Specification and the Associated Specifications or Specification Sheets, the latter governs because it describes the specifics of a product while the general specification encompasses a family of products.
Generic or Guide	A Generic or Guide Specification is a tool for preparing a number of similar specifications for a class of like end items to be developed. The guide specification is a "template," which identifies all of the essential performance parameters normally associated with the class of item, but does not provide the specific performance capabilities. The specification is then tailored to fill in the blanks to create a specific system or item specification. Some specific, but design-independent, performance capabilities may be provided by the Government, prior to an RFP. The remaining performance capabilities would then be provided by each offerer. Typically inputs to the system and item specification are generated from the activities of prior program phases. Contractors also create generic specifications to use as "boilerplate" for preparation of a number of different item specifications with common requirements deriving from a common operating environment.

Activity Guide: Table 3-6. Specification Types Categorized by Object

This table describes the type of CI "objects" that a specification is intended to define. This category is part of a string of categories which comprise the specification type. ***[See Fig. 3-3]***

Object	Description
System	A system specification defines the overall performance and mission requirements for a system, allocates requirements to lower level components of the system, and identifies system interface and inter-operability constraints. It is the top-level functional requirements specification for the system. A system specification is used to establish a functional baseline for the system. Large systems are usually decomposed; level two system components are often complex enough to be called "systems" themselves (although, for configuration management purposes, they are designated as Subsystems or CIs)
Item	The Item specification for a CI defines the performance and interface requirements and design and inter-operability constraints that have been allocated to the CI from a system or higher level CI. Item specifications provide the contractual basis for the development and verification of CI performance. The item performance (development) specification(s) will normally be used to establish the allocated baseline for the CI. An item performance (product) specification (essentially the same document) or an item detailed specification (containing specific design requirements) is used to provide the contractual basis for acquisition of production quantities of the CI. (See d.)
Software	Computer Software Configuration Items (CSCIs) are documented with software specifications prepared in accordance with MIL-STD-961D. A Software Performance Specification is similar to the Software Requirements Specification (formerly required by MIL-STD-2167A, and MIL-STD-498). A Software Detailed Specification is similar to the Software Requirements Specification plus the set of design documents describing the software, interface and database design. **[See Table 3-9]**
Material	Material specifications are used where a raw material, mixture, or semi-fabricated material has been developed specifically for use with a particular item or system and is critical to the performance or design of the item. (Example a missile rocket motor solid propellant chemical mixture.) The material specification is called out in the CI(s) design documentation. It therefore becomes part of the product baseline of the CI(s)
Process	Process specifications are used where a process (or service) has been developed specifically for use with a particular system/item and is critical to its performance or design. (A common Example - the curing process for the missile rocket motor solid propellant.) The process specification forms a part of the product baseline of the CI(s)

Activity Guide: Table 3-7. Specification Types Categorized by Purpose

This table describes the categories which indicate the intent of the specification, i.e., distinguish between performance and detail specifications. This category is part of a set of categories which comprise the specification type. ***[See Fig. 3-3]***

Purpose Category	Description
Performance	A performance specification provides requirements for a system, item, software, process or material in terms of the required results and the criteria for verifying compliance. It defines the functional requirements, the operational environment, and interface and interchangeability requirements but does not state how the requirements are to be achieved; require the use of specific materials or parts; or give design or construction requirements beyond those design constraints necessary to unambiguously define interface and interchangeability requirements. The intent of a performance specification is to allow more than one design solution for the requirements specified so that interchangeable competitive products may be evaluated, and new technology may be inserted.
Detail	A detail specification may consist of all detail requirements or a blend of performance and detail requirements (MIL-STD-961D). However, the DoD preference is for one specification to convey all the performance and detail requirements for an item so that, for repetitive re-procurement, the function and performance attributes of the product are included. In fact, in appendix A of MIL-STD-961D (which addresses program unique specifications), clearly states that unified, rather than separate development/requirements and product specifications are to be prepared. One intent of the detailed specification, as a revision of the performance specification, is to provide sufficient detail to distinguish the features of one design solution for an item from other competing design solutions. Another intent is to specify details of the design solution, such as the use of specific parts and materials, that are essential for critical, safety or economic reasons, but to state as many requirements in performance terms as possible. When the Government baselines a detail specification, it limits its re-procurement choice to a particular design solution, and when a contractor agrees to that baseline, some design change flexibility is surrendered. What makes a stated requirement a design requirement and not a performance requirement is that it prescribes design, construction, material or quality control solutions, rather than allow contractor development flexibility.

3.4.3 Design Solution Document Concepts

The requirements of the functional and allocated baselines **[See 3.5]** are basically design constraints on the development contractor. The design solution evolves from the contractor's design and development process during the engineering and manufacturing development phase of the life cycle. This process essentially converts the performance requirements of the baseline specification into a specific product definition that can be manufactured to produce a hardware item or compiled to produce a software item. It is documented in design documentation for the hardware and the software comprising each CI.

For hardware, the design documentation may be in the form of engineering drawings and associated lists, and the material and process documents that are referenced by the drawings. In the current information environment, the primary design documentation source may be in the form of two or three dimensional engineering models. In that case, a drawing is simply a two dimensional view of a model that exists in a data base file. Various models and product modeling tools may be employed. Engineering drawings may or may not exist as a central part of the product manufacturing process, depending on the product and the degree of automation technology employed.

In an automated development and production environment, an item is designed on the engineerš workstation, manufacturing instructions are added at the manufacturing plannerš workstation and the results are fed directly to automated machinery that produces the item. Commonly, items are designed using computer-aided design tools (CADAM, CATIA, AUTOCAD, etc.) and engineering drawings are plotted for human checking and review. Where engineering drawings are required as a contract deliverable, they should be delivered in place, in a CALS compliant format.

For software, the design evolves through a software engineering process, using a variety of integrated tools, often called the software engineering environment, e.g., Computer-aided software engineering (CASE). The process results in computer based versions of documentation **[See Activity Guide: Table 3-9. Software Documentation],** source, and executable code for every CSCI. The process the contractor employs to manage the automated software documentation (e.g., software library management and archiving) is similar to the process used to manage automated hardware documentation, although different tools may be employed. Upon close examination, it is fundamentally the same process used to manage the files which contain software code. That is why, in MIL-STD-2549, you will find the same business rules applied to both software and documents in terms of their identification and relationships to other entities. **[Section 7 and Appendix B]**

Acquisition reform has essentially freed the contractor to evolve the most efficient methodology for evolving the design solution in a way that is appropriate to the scope and complexity of the particular product or product line. It is important for the acquisition program manager to recognize that there will be a great deal of diversity in the methodologies employed by various contractors, although there will also tend to be a great deal of similarities within given industry segments such as aerospace. Where it is necessary for the Government to capture the detailed design, the business rules of MIL-STD-2549, implemented in a Government CM AIS, will provide the means for a contractor to map the information in his internal data bases to the appropriate fields of the Governmentš CM AIS. **[Section 5 and Appendix B]**

The developmental configuration documentation to be managed by the development contractor consists of the design and technical data under the contractor's internal control. Some of this data may transition to Government configuration control and be designated as the Government Product Baseline; some of it may remain under Contractor configuration control and be designated as Contractor Product Baseline. **[3.5.1, 3.5.2]** The developmental configuration management process implemented by the development contractor consists of a formal process to control the documentation and repositories containing the elements of the developmental configuration. The contractor's engineering release system **[Details: 3.7]** and engineering release records are an important part of this management process. Each and every version of all elements of the developmental configuration released, for whatever purpose, should be maintained, along with the reasons the version was released, and the rationale for superseding the previous version.

3.4.4 Design Solution and Software Documentation Activity Guides

Tables 3-8 and 3-9 provide detailed information concerning the documentation used to document the design solution.

Table 3-9 also contains a complete set of software documents that are used for planning, system and software requirements analysis, software integration and testing, software product definition, operation and maintenance in addition to design description. Several software design description documents can evolve from earlier versions used to support one or more of these other functions. The Government needs access to some of these documents to the extent necessary for logistic support and software maintenance during the operational support period. This activity guide therefore addresses the documentation that can evolve over the full life cycle of a system/CSCI.

Detailed design documents for the CIs and CSCIs that the Government will support will be made accessible from a Government repository (e.g., JEDMICS). Meta-data concerning these documents will be available from CM AIS provided that the information that the Government requires the contractor to load into these systems is specified in the contract. **[Section 5, Section 7 and Appendix B]**

Activity Guide: Table 3-8. Engineering Drawings and Associated Lists

Subject	
Sub-topic/Reference	**Description**
Definition	
• MIL-STD-100 • ASME Y-14.1 • ASME Y14.24. • ASME Y14.34 • ASME Y14.35 • ASME Y14-100M • MIL-DTL-31000	A drawing is an engineering document or digital data file that discloses the physical and functional requirements of an item (directly by means of graphic and textual presentations, or by reference). Drawings communicate a variety of information, both textual or graphic. All drawings have certain common elements. Normally several types of engineering drawings combined into sets with associated lists are required to completely define the end-product requirements of an item. Drawings may be categorized into the following **MIL-DTL-31000** Technical Data Package (TDP) elements: - Conceptual design drawings - Developmental design drawings - Product drawings - Commercial drawings - Special inspection equipment drawings - Special tooling drawings
Drawing Types & Applications	
• ASME Y14.24M • MIL-STD-100	• **Detail, assembly, control, installation and diagrammatic drawings** - as necessary, provide engineering description and control of product attributes. • **Ancillary drawings** (drawings supplementing end-product drawings) and special application drawing types aid logistics, configuration management, manufacturing, or other functions. • **Additional DoD-unique types:** procurement control, design control, vendor item control, microcircuit drawing set, paint scheme, software, transportability, camouflage basis and pattern, combination of adopted items, kits, package content
Common Drawing Sheet Sizes and Format	
• ASME Y14.1 • ASME Y14.1M Note: In this instance there are separate documents for english and metric units respectively	• **Drawing sheet sizes -** Standard sizes for engineering drawing sheets, e.g., A, B, C, etc. • **Title block** - Design activity name and address, drawing title, drawing number, drawing size, CAGE Code, drawing scale, drawing sheet size, number of sheets (for a multi-sheet drawing). Most formats include drawing approval authority and angle of projection symbols. • **Revisions block** - Usually in the upper right hand corner. See Revisions to drawings, below. • **Optional blocks** - Additional blocks may be included on a drawing format adjacent to the Title Block. Examples: Application Block and Mechanical Properties Block
Drawing Variables	
• ASME Y14.1, 14.1M • MIL-STD-1840 (Gen) • MIL-PRF-28000 (IGES) • MIL-PRF-28001 (SGML) • MIL-PRF-28002 (Raster) • MIL-PRF-28004 (PDES) • ASME Y14.100M • MIL-STD-100[1]	• **Media** – **Hard copy** - Single sheet, multi-sheet, tabulation, book-form, drawings for microcircuits – **Digital -** Magnetic tape, Raster Image, IGES, PDES/STEP representations • **Format** – **Contractor** - Contractor title block, CAGE code and process – **Government** - For repetitive re-procurement of identical items, Government title block, CAGE code and release control • **Detail options** – **Mono-detail** - Each drawing covers a single part or assembly – **Multi-detail** - A drawing may cover an assembly and detail parts • **Dimensioning and tolerancing** - Several conventions may be chosen

[1] MIL-STD-100 supplements ASME Y14.100M (which reflects industry practice) for specific essential DoD requirements.

Activity Guide: Table 3-8. Engineering Drawings and Associated Lists

Subject	
Sub-topic/Reference	**Description**
	• **Drawing notes -** Short, concise statements providing clarification. They may apply to the entire drawing or any portion of the drawing. Notes do not include contractual requirements or requirements for data submission, approval or distribution. Preferably Notes are located on sheet 1 of the drawing, or direction is included on sheet 1 indicating location of notes, i.e., on parts list, or separate associated list.
Associated Lists	
• ASME Y14.34M • MIL-STD-100	• **Parts list** - a tabulation of all parts and bulk materials (except those materials which support a process) used in the item to which the list applies. Parts Lists may be Integral Parts Lists, prepared and maintained as part of the actual engineering drawing, or Separate Parts Lists, prepared as a document separate from the drawing with which it is associated and maintained independently from that drawing. • **Data list** - a tabulation of all engineering drawings, associated lists, specifications, standards, and subordinate data lists pertaining to the item to which the data list applies • **Indentured data list** - that is structured by successive assembly level • **Index list** -- a tabulation of data lists and subordinate index lists pertaining to the item to which the list applies • **Wire list** - a tabulation of all the wires in an assembly which indicates their identification and terminations • **Application list** - a tabulation of parts and the next higher assemblies into which they install. (Commonly referred to as a where used list.)
Revisions to Drawings	
• ASME Y14.35M • MIL-STD-100	• Drawing revision identification • Any change to a drawing, including a change to Rights-in-Data, must be recorded in the revisions block of the affected drawing. • Record revision status, identification of change authorization documents, or description of changes, and change approvals, and if multi-sheet, revision status of sheets **Note:** If revision history is maintained in a data base, common practice is to provide it as part of an associated list (e.g. parts list) or via data base access rather than on the field of the drawing
Numbering Coding and Identification	
• ASME Y14.100M • MIL-STD-100	• Drawing and part identification rules liberal enough to accommodate a wide variety of industry practices. Any keyboard characters allowed. • Limited to precise drawing and part identification discipline necessary to provide unique identification for military equipment (e.g., use of CAGE codes, part identity keyed to drawing identity) • Original and current design activity; design disclosure, delivery of drawing originals • Drawing title conventions • Special markings, symbols and part/item replacement notations • Marking for shipment and storage • Special items and processes (e.g., system safety, electrostatic discharge) • Type designators
Drawing Requirements Manual (DRM); Tailoring and Application Guides	
• ASME Y14.100M • MIL-STD-100	• Drawing or Drafting Manuals are a reference defining in-house practices and extent of applicability of Standards. Government activities use tailoring or application guides. • The DRM, guides and standardizes drawing form and presentation, facilitate communication (of intent and technical detail), assure consistent quality, simplify training, and provide a basis for improving practices.

Activity Guide: Table 3- 9. Software Documentation

SW Life Cycle Process[2] (Engineering View/ Development Process) Purpose			
Acronym[3]	**DOCUMENT[4] Description (Keywords)**	**MIL-STD-961D Equivalent [See 3.4.1, 3.4.2]**	**Config Doc? Baseline? [See 3.5.1, 3.5.2]**
Process Implementation - Planning			
OCD	*Operational Concept Document* - proposed system; user needs	• No MIL-STD-961 equivalent: These documents are not specifications	• Not configuration documentation. • Data Control Only (i.e., Baseline internal to developer for document, document representation and file management purposes only). [**See Section 7**]
SDP	*Software Development Plan* - development effort; process, methods, schedules, organization, resources. (Includes or refers to SCM & SQA plans)		
STP	*Software Test Plan* - Qualification testing; SW item; SW system; environment, tests, schedules		
SIP	*Software Installation Plan* - installing SW; user sites; preparations; training; conversion		
STrP	*Software Transition Plan* - transitioning to maintenance organization; HW; SW; resources; life cycle support		
System Requirements Analysis & Architectural Design			
SSS	*System/Subsystem Specification* - Specifies system or subsystem requirements; requirement verification methods. (May be supplemented with system level IRS)	• Program Unique System Performance specification	• Functional or Allocated Baseline
SSDD	*System/Subsystem Design Description* - system/subsystem-wide design; architectural design; basis for system development. (May be supplemented with IDD, DBDD)	• Part of Program Unique System Detail specification	• Design release[5]
Software Requirements Analysis & Design			
SRS	*Software Requirements Specification* - specifies SW requirements; verification methods. May be supplemented with IRS)	• Both part of Program Unique Software Performance or Detail Specification	• (Government or Contractor) Allocated Baseline for CSCI
IRS	*Interface Requirements Specification* - specifies interface requirements for one or more systems, subsystems, HW items, SW items, operations or other system components; any number of interfaces (Can supplement SSS, SSDD, SRS)		
Software Architectural and Detailed Design			
SDD	*Software Design Description* - SW item-wide design decisions; SW item architectural design; detailed design, basis for implementing[6]; information for maintenance (May be supplemented by IDD, DBDD)	• All are part of Program Unique Software Detail Specification	• All are Config Doc • Design release
IDD	*Interface Design Description* - interface characteristics; one or more systems, subsystems, HW items, SW items, operations or		

[2] Life Cycle processes in accordance with ISO/IEC 12207. Tailoring guidance: For a SW product embedded in a system, all life cycle process activity should be considered, relevant activities should be applied and tailored for each subsystem or configuration item; for a standalone software project, the system activities may not apply.
[3] Document types in accordance with Joint Standard 016 and ISO/IEC 12207
[4] ISO/IEC 12207 emphasizes that the documentation is variable and tailorable to fit the project. Other documentation that meets the intent is acceptable.
[5] Contractor design release baseline; alias development configuration, release record
[6] Coding and testing the SW

Activity Guide: Table 3- 9. Software Documentation

Acronym[3]	DOCUMENT[4] Description (Keywords)	MIL-STD-961D Equivalent [See 3.4.1, 3.4.2]	Config Doc? Baseline? [See 3.5.1, 3.5.2]
	SW Life Cycle Process[2] (Engineering View/ Development Process) Purpose		
	other system components; any number of interfaces; detail companion to IRS; communicate and control interface design decisions (Can supplement SSDD, SDD)		
DBDD	*Data Base Design Description* - data base design; related data, files, SW/data base management system for access, basis for implementation and maintenance		
	Software Integration and Qualification Testing		
STD	*Software Test Description* - test preparations; test cases; test procedures; qualification testing SW item, SW system or subsystem	• No MIL-STD-961 equivalent. These documents are not specifications	• Not configuration documentation. • Data Control • Evaluate change to config docs for impact on these test docs
STR	*Software Test Report* - record of test performed; assess results.		
	As-Built Software Product Definition		
SPS	*Software Product Specification* - Contains or references executable SW, source files; SW maintenance information; "as-built" design information,[7] compilation, build, modification procedures; primary SW maintenance document	• Part of complete Program Unique Product Detail specification	• Product baseline; either Government or Contractor
SVD	*Software Version Description* - identifies and describes a SW version; used to release, track and control each version	• No MIL-STD-961 equivalent: This document is not a spec	• Not baselined. Status Accounting record for released SW Version
	System Operation		
SUM	*Software User Manual* - hands-on software user; how to install and use SW, SW item group, SW system or subsystem		• Not configuration documentation.
SIOM	*Software Input/Output Manual* - computer center; centralized or networked installation; how to access, input and interpret output; batch or interactive. (With SCOM is alternative to SUM)	• No MIL-STD-961 equivalent. These documents are not specifications	• Data Control • Evaluate change to configuration documents for impact on these manuals
SCOM	*Software Center Operator Manual* - computer center; centralized or networked installation; how to install and operate a SW system (With SIOM is alternative to SUM)		
COM	*Computer Operator Manual* - information needed to operate a given computer and its peripherals		
	System/Software Maintenance		
CPM	*Computer programming Manual* - Information needed by programmer to program for a given computer; newly developed; special purpose; focus on computer not on specific SW.	• No MIL-STD-961 equivalent. These documents are not specifications	• Not configuration documentation. • Data Control • Evaluate change to config docs for impact on these test docs
FSM	*Firmware Support Manual* - information to program and re-program firmware devices in a system; ROMs; PROMs; EPROMs, etc.		

[7] May be updated SDD, IDD, DBDD

3.5 Configuration Baselines

The concept of baselines is central to an effective configuration management program; it is however, not a unique configuration management concept. The idea of using a known and defined point of reference is commonplace and is central to an effective management process. The essential idea of baselines is that in order to reach a destination it is necessary to know your starting point. In order to plan for, approve, or implement a configuration change, it is necessary to have a definition of the current configuration that is to be changed. In order to manage a program effectively it is necessary to baseline the objectives for cost, schedule, and performance.

The Acquisition Program Baseline (APB), established at Milestone I and refined at Milestones II and III **[Ref: DOD 5000.2-R; Recall Fig. 2-5]**, provides the Program manager with key cost, schedule, and performance objectives and thresholds, which if not met, would require a re-evaluation of alternative concepts or design approaches. This baseline bears a close relationship with the configuration baselines described in this section. The performance thresholds in the APB must be reflected in the system or top level CI specification that constitutes the functional baseline for the program for those thresholds to be achieved.

In configuration management, a configuration baseline is a fixed reference configuration established by defining and recording the approved configuration documentation for a System or CI at a milestone event or at a specified time. Configuration baselines represent:

- Snapshots which capture the configuration or partial configuration of a CI at specific points in time
- Commitment points representing approval of a CI at a particular milestones in its development
- Control points which serves to focus management attention.

3.5.1 Configuration Baseline Concepts

Major configuration baselines known as the functional, allocated, and product baselines as well as the developmental configuration, are associated with milestones in the life cycle of a CI. Each of these major configuration baselines is designated when the given level of the CI's configuration documentation is deemed to be complete and correct, and needs to be formally protected from unwarranted and uncontrolled change from that point forward in its life cycle. Under MIL-STD-973 and earlier configuration management standards, these baselines all signified departure points for Government configuration control; they must now be redefined for post acquisition reform application because either Government or Contractor configuration control may apply. The new definitions reflect the same purpose for each baseline, however the configuration control activity (which approves of changes to the baseline) is treated as a separate variable. **[Details: Activity Guidelines: Fig. 3-4a.-e.]**

- Functional baseline - The approved configuration documentation describing a system's or top level configuration item's performance (functional, inter-operability, and interface characteristics) and the verification required to demonstrate the achievement of those specified characteristics.

- Allocated baseline - The current approved performance oriented documentation, for a CI to be developed, which describes the functional and interface characteristics that are allocated from those of the higher level CI and the verification required to demonstrate achievement of those specified characteristics.

- Development configuration - the contractor's design and associated technical documentation that defines the contractorš evolving design solution during development of a CI. The developmental configuration for a CI consists of that contractor internally released technical documentation for hardware and software design that is under the developing contractor's configuration control.

- Product baseline - The product baseline is the approved technical documentation which describes the configuration of a CI during the production, fielding/deployment and operational support phases of its life cycle. The product baseline prescribes:
    - All necessary physical or form, fit, and function characteristics of a CI,
    - The selected functional characteristics designated for production acceptance testing, and

- The production acceptance test requirements

When used for re-procurement of a CI, the product baseline documentation also includes the allocated configuration documentation to insure that performance requirements are not compromised

Each configuration baseline serves as a point of departure for future CI changes. The current approved configuration documentation constitutes the current configuration baseline. Incremental configuration baselines occur sequentially over the life cycle of a CI as each new change is approved. Each change from the previous baseline to the current baseline occurs through a configuration control process **[Details: Section 4]**. The audit trail of the configuration control activity from the CI's original requirements documentation to the current baseline is maintained as part of configuration status accounting. **[Detail: Section 5]**

From a government acquisition program perspective, the functional baseline is established when its associated functional configuration documentation is approved by the Government. This baseline is always subject to Government configuration control. The functional baseline consists of the functional configuration documentation (FCD) which is the initial approved technical documentation for a system or top level CI as set forth in a system specification prescribing:

- All necessary functional characteristics
- The verification required to demonstrate achievement of the specified functional characteristics
- The necessary interface and inter-operability characteristics with associated CIs, other system elements, and other systems
- Identification of lower level CIs, if any, and the configuration documentation for items (such as items separately developed or currently in the inventory) which are to be integrated or interfaced with the CI
- Design constraints, such as envelope dimensions, component standardization, use of inventory items and integrated logistics support policies.

The Governmentš functional baseline is usually defined as a result of Phase I, Program Definition and Risk Reduction, when a Phase I is included in the acquisition strategy. In the absence of a Phase I, the functional baseline is established at the beginning of Phase II, Engineering and Manufacturing Development. From a contractorš point of view, a functional baseline, whether formally established or not, is always in place at the inception of Phase II. It is represented by whatever documentation is included or referenced by the Phase II contract to define the technical/performance requirements that the contractorš product is obligated by the contract to meet.

The allocated baseline is, in reality, a composite of a series of allocated baselines. Each allocated baseline consists of the allocated configuration documentation (ACD) which is the current approved performance oriented documentation governing the development of a CI, in which each specification:

- Defines the functional and interface characteristics that are allocated from those of the system or higher level CI.
- Establishes the verification required to demonstrate achievement of its functional characteristics.
- Delineates necessary interface requirements with other associated CIs, and
- Establishes design constraints, if any, such as component standardization, use of inventory items, and integrated logistics support requirements.

The requirements in the specification are the basis for the contractor's design of the CI; the quality assurance provisions in the specification form the framework for the qualification testing program for the CI. The initial allocated baseline may be established at the end of Phase I, Program Definition and Risk Reduction, or early in phase II, Engineering and Manufacturing Development. The allocated baseline for each CI is documented in an item performance (or detail) specification, generally referred to as a development specification.

The specification(s) defining each allocated baseline is subject to configuration control by either the Government or by the contractor. The configuration control activity determination is very simply made as follows:

- The Government is the configuration control authority for those allocated specifications/baselines that have been issued, or approved by the Government. The Government will control the specifications for CIs that it will organically provide logistic support
- The contractor will be the configuration control authority for the allocated specifications for CIs at a lower level that it will logistically support.

Based on the definition of the functional, allocated and product baselines as Government baselines, there has always been considerable confusion as to what to call the baseline established between a contractor and a sub-contractor. From the contractor's point of view, it is an allocated baseline. From the sub-contractor's view, it is a functional baseline since it constitutes the top level requirement that the sub-contractor must meet, and which the sub-contractor may need to allocate further down the CI tree **[Fig. 3-2]**. Whether this baseline is considered a functional baseline, an allocated baseline, or a functional/allocated baseline, is immaterial so long as the configuration control requirements for the related configuration documentation are clearly established.

Interface control documents **[See 3.8]** are considered part of the functional and/or allocated baselines to the extent that they are referenced in and supplement the performance specifications that constitute the applicable baselines.

Contractor implementation of the functional and allocated baseline requirements involves the creation, and release of engineering documentation that incrementally defines the configuration of the specific product. It represents the contractors detailed design solution. It may or may not include a detail specification for the product. The contractor is responsible for the configuration control of the developmental configuration and may iteratively design, release, prototype and test until the functional and allocated requirements are satisfied. The developmental configuration will ultimately include the complete set of released and approved engineering design documents, such as the engineering drawings and associated lists for hardware and the software, interface and database design documents for software. By reference within this documentation, it also includes test and verification documents

The product baseline is the approved documentation which completely describes the functional and physical characteristics of the CI, any required joint and combined operations interoperability characteristics of a CI (including a comprehensive summary of the other environment(s) and allied interfacing CIs or systems and equipment). It consists of the Product Configuration Documentation (PCD) which is the current approved technical documentation describing the configuration of a CI during Phase III, the Production, Fielding/Deployment and Operational Support phase of its life cycle. The product baseline prescribes:

- All necessary physical or form, fit, and function characteristics of a CI,
- The selected functional characteristics designated for production acceptance testing, and
- The production acceptance test requirements,
- All allocated configuration documentation pertaining to the item, so that if the item were to be re-procured, the performance requirements for the item would also be included.

The product baseline documentation includes the complete set of released and approved engineering design documents, such as the engineering models, engineering drawings and associated lists for hardware; and the software, interface and database design documents for software. These are the then current configuration of the documents that were considered the developmental configuration. The product baseline may include the 2-D or 3-D engineering model of a hardware product, and for software, it includes a representation of the CSCI source code. It also includes by reference, the material and process specifications invoked by the engineering documentation.

The configuration control authority for the product baseline for each CI is determined with the same supportability test as the allocated requirements, described above. The Government needs to take delivery of and control product configuration documentation at a level of detail commensurate with the operational, support and re-procurement strategies for the given program. For repairable CIs developed wholly or partly with Government funding, design disclosure documentation is required to the lowest level at which the CI will be operated, maintained, repaired, trained, supported and re-procured. A significant factor in this determination is data which is properly established as "Contractor proprietary." The Government shall determine if it is necessary and cost effective to buy rights to the data, do without it, develop new data and CIs, or return to the original contractor whenever re-procurement or support of the CI is needed. When a CI is wholly developed with private funding and is acquired by the

Government, the data normally available for the item (typically form, fit and function documentation) is evaluated and included in the appropriate baselines.

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The functional, allocated, and product configuration documentation must be mutually consistent and compatible. Each succeeding level of configuration identification is a logical and detailed extension of its predecessor(s). The specification structure of MIL-STD-961D, Appendix A, facilitates this congruence since a separate specification is not created when a performance specification transitions to a detailed specification. **[3.4.1, 3.4.2]**. Redundant documentation should be avoided to minimize the possibility of conflicts. If a conflict arises between levels of configuration documentation, the order of precedence is always FCD, ACD, PCD.

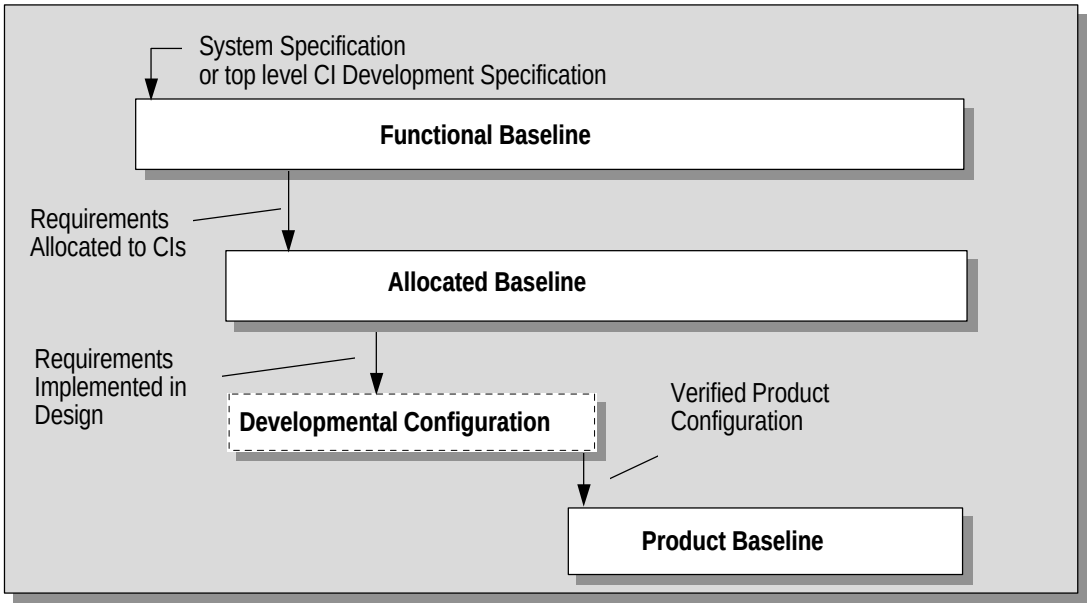
When viewed on a system basis, care must be exercised to assure that all of the top level requirements are accounted for in individual lower level documents. This is a key function of such reviews as system, preliminary and critical design reviews but is greatly facilitated by the use of automated requirements allocation and traceability tools.

3.5.2 Configuration Baseline Activity Guides

As can be seen from the above discussion, performance oriented acquisition strategy has introduced considerable flexibility into the configuration baseline process. There will however be a long period of transition as pre-existing programs either phase into the new methodology or complete their life cycle under prior acquisition strategy. In many programs there will continue to be a mix of philosophy, as dictated by the results of cost trade-offs. Therefore the application guides in this section reflect a variety of baseline methodologies which may be contractually in place.

Figures 3-4a. and b. reflect the two latest Change Notices to MIL-STD-973. **Fig. 3-4a**. also reflects the baseline concept of MIL-STD-480B, MIL-STD-483, etc, which preceded MIL-STD-973. These standards have been superseded but continue to effect follow-on legacy system contracts where it is not cost effective to upgrade to new standards. **Fig. 3-4c** reflects the baseline concept of EIA/IS-649, the National Consensus Standard for Configuration Management. It is viewed from the industry perspective as the baselines that a contractor would establish for himself to manage his product. It is compatible with and maps easily to any of the other baseline concepts. **Figs 3-4d. and 3-4e**. illustrate the performance based acquisition baseline concepts described in **3.5.1.** They show several of the flexible options the Government may exercise based on acquisition strategy, logistic support planning and sound management judgment.

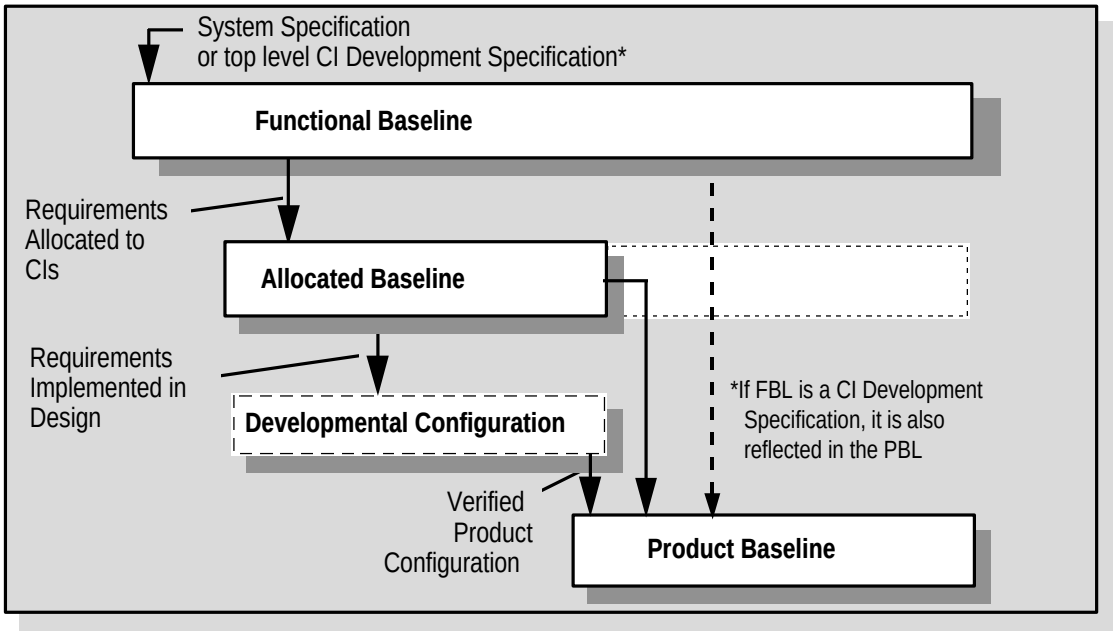
Figure 3-4a. *Activity Guide:* MIL-STD-973 Baseline Concept



Description:

- Functional, allocated and product baselines under Government configuration control; developmental configuration under contractor configuration control
- Three baselines maintained concurrently during Production, Fielding/Deployment and Operational support

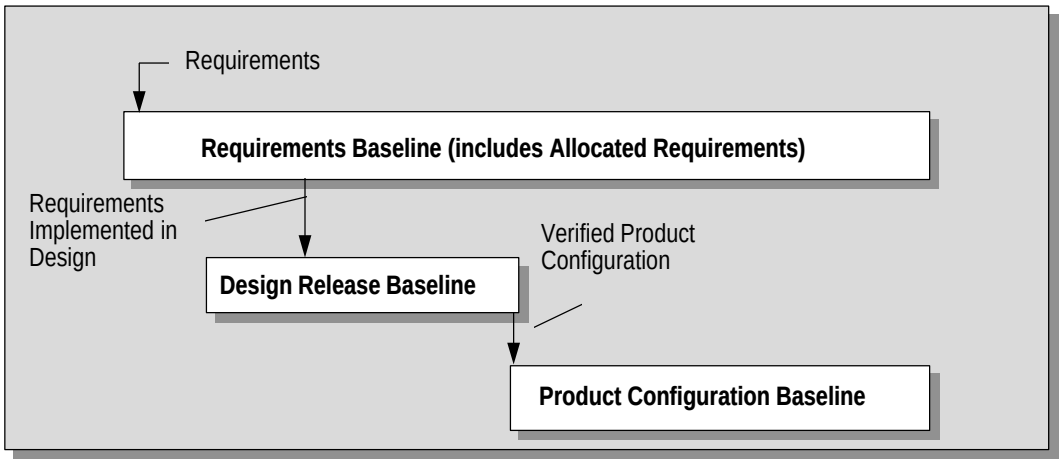
Figure 3-4b. *Activity Guide:* MIL-STD-973, Notice 3 Baseline Concept



Description:

- Same as Fig. 3.4a, except that Product baseline incorporates the ACD describing a CI's functional, performance, interoperability and interface requirements and the verifications required to confirm the achievement of those specified requirements

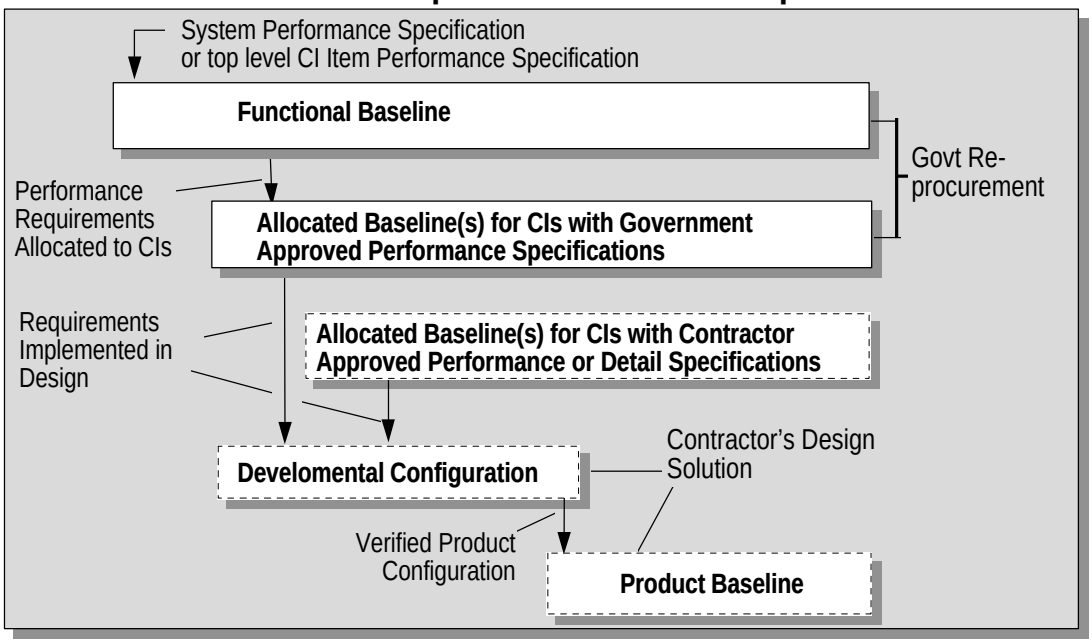
Figure 3-4c. *Activity Guide:* EIA 649 Baseline Concept



Description:

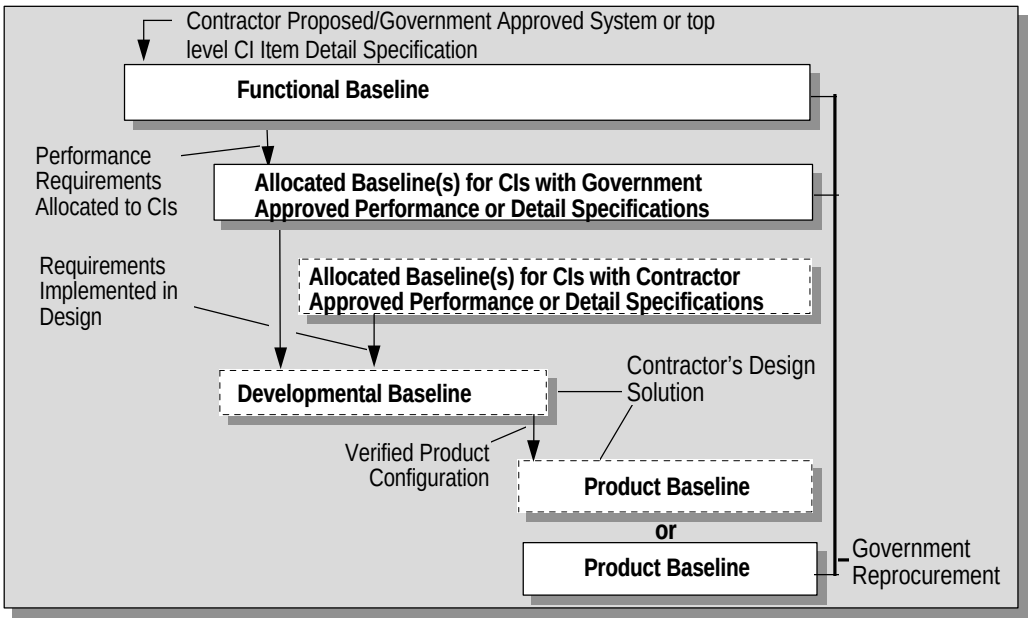
- Requirements Baseline is the customer baseline, whether the customer is external or internal to the organization. It includes any allocated requirements since they are merely a next level requirements baseline
- Design Release Baseline is similar to the Developmental Configuration in Figs. 3-4 a. and b.
- Product Configuration Baseline is similar to the Product baseline in Figs. 3-4 a. and b. It is always controlled by the developing contractor
- Conceptually this Schema readily maps to any Customer baseline concept. If a contractor is using this concept, his system should be compatible.

Figure 3-4d. *Activity Guide:* Performance-Based Acquisition Baseline Concept - Scenario 1



Description: In this scenario, the Government does not take control of the Product baseline. The other major difference caused by acquisition reform is that there are some allocated requirements controlled by the Government; some by the contractor. The Government re-procures to performance requirements only.

Figure 3-4e. *Activity Guide:*
Performance-Based Acquisition Baseline Concept - Scenario 2



Description: In this scenario, the Government may take control of some or all of the Product baseline and some allocated baselines contain detail item specifications.The Government re-procures to combined functional, allocated and product baselines

3.6 Document and Item Identification

This section describes the concepts for the assignment of identifiers to CIs, component parts and their associated configuration documentation. Clearly identified items and documentation are essential to effective configuration management throughout the life cycle, particularly during the deployment and operational support period when the marking on a part is the key to installing a correct replacement part and finding the proper installation, operation and maintenance instructions.

3.6.1 Document Identification Concepts

A document identification principle expressed in EIA/IS-649 is that each configuration document (as well as other documents) must have a unique identifier so that it can be associated correctly with the configuration of the item to which it relates. The DoD and all Military components use the following three elements to assure the unique identity of any document: CAGE code, document type and document identifier. In addition, revision identifier and/or date clearly specifies a specific issue of a document. **[Detail: 3.6.4, Activity Guidelines: Table 3-10]**

A document can have many representations, as for example a word processor file and a paper copy; a CAD file and a representation of that CAD file inserted in a document. In addition to the identification assigned to each document, the digital files for each version of each representation of the document, and its component files must be identified and managed. **[Detail: Section 7, Data Management]**

It is the responsibility of each individual assigned to manage an item of configuration documentation to employ the appropriate procedures of his organization which ensure:

- The assignment of identifiers to the configuration documentation, including revision and version identifiers, when appropriate, and procedures to control the engineering release of new/revised data. **[Refer to 3.6.2 and 3.7]**
- The application of applicable restrictive markings. **[Detail: 3.6.2, Activity Guide: Table 3-10]**

3.6.2 Document Identification Activity Guides

Table 3-10 provides document identification detail.

Activity Guide: Table 3-10. Document Identification

Preferred Identifier Element	Definition
Document Identifier	
CAGE Code or NSCM (NATO Supply Code for Mfg.)	CAGE (and NSCM) Codes identify the source of the document. The codes are provided in **Defense Logistic Agency (DLA) Cataloging Handbook H4/H8 Series.** The codes are affixed to all CIs, and their *replaceable* subordinate parts and assemblies. They are also part of the identification marking of each item of configuration documentation, software media and software product.
Document Type	For purposes of entering information about configuration documents into the CM AIS system, there is a series of standard document identifiers and document type codes to be used along with the CAGE and document number. These codes do not in any way restrict the ability of the preparing activity to identify documents. Rather they provide standard data base data element identifiers so that each document reference can be entered into the proper field and bear the correct relationships to other fields of information. These code names will be largely transparent to the originating and using organizations. They will be employed primarily in the translation and mapping of information from one automated system/data base to another using a universal data element framework. **[See 5.2, 7.2.1, and Appendix B]**
Document Identifier	The document Identifier distinguishes one document produced by the organization referenced by the CAGE code from another. Each document and each revision thereto, requires the document identifier. There are as many schemes for identifying documents as there are organizations producing them, so there is no standard format for all documents. There are however, a few common sense constraints on the numbering content for some specifications, and engineering drawings, as defined in applicable standards
Revision/Version identifier	
Revision Identifier	Revision Identifier clearly establishes which issue of a particular document is current or applicable.
Version Identifier	Conceptually the same as revision, version is the term typically used for files
Date	Date is an additional discriminator. It is good common sense business practice to date every document and every revision
Restrictive Markings: ***These requirements apply to digital data files and digital media as well as to paper documents and are all intended to limit the access to such data to those entitled to access them.*** **[Ref: DoD FAR Supplements 252.227-7013, 7018, 7032 and -7037]**	
Security Markings	Security markings are required to be clearly marked on all classified data and special handling requirements apply. Each contract contains classification guidance and direction, which must be strictly adhered to.
Distribution Statements	Specific distribution statements and export restrictions must be marked on information subject to secondary distribution limitations as prescribed by law and as indicated by the contract. The purpose of these markings is to inform the secondary distributor, such as a Government repository whether they can legally provide the subject information to third parties, and if the data are allowed to be exported to foreign countries.
Data Rights	Documents which contain data for which the Government or other parties do not have unlimited rights, must be appropriately labeled to indicate the data rights limitations, so that proprietary information disclosed to the Government for specific purposes is protected.

3.6.3 Item Identification Concepts

The following principles in EIA-649 apply to the Identification of Configuration Items; the terminology in parentheses are the common terms used in the defense, aerospace and electronics industries:

- All products (Configuration Items) are assigned unique identifiers (e.g., Nomenclature, CAGE, Part/Item Number) so that one product can be distinguished from other products; one configuration of a product can be distinguished from another; the source of a product can be determined; and the correct product information can be retrieved.
- Individual units of a product are assigned a unique product unit identifier (Serial Number) when there is a need to distinguish one unit of the product from another unit of the product.
- When a product is modified, it retains its original product unit identifier (Serial Number) even though its part identifying number is altered to reflect a new configuration.
- A series of like units of a product is assigned a unique product group identifier (Lot Number or Date Code) when it is unnecessary or impracticable to identify individual units but nonetheless necessary to correlate units to a process, date, event, or test.

Contractors assign identifiers including serial and lot numbers to CIs and their component parts, as necessary to establish the CI effectivity of each configuration of each item of hardware and software. Items are marked or labeled with their applicable identifiers to enable correlation between the item, its configuration documentation, and other associated data, and to track maintenance and modification actions performed. Thus, serial and lot numbers are also known as tracking identifiers. For software, applicable identifiers are embedded in source and, when required, in object code and in alterable read-only memory devices (firmware).

a. Military Nomenclature and Nameplates.

The contract should specify requirements for the assignment of Government type designators and Nomenclature to CIs for which the Government needs to control, track and provide logistic support. Government Nomenclature is requested by a contractor and is included on CI nameplates. **[Detail: 3.6.4 Activity Guide: Table 3-11]**

b. Part/Item Identification Numbers (PIN)

A discrete part/item identification number (PIN), generally referred to as a part number, is assigned by the developing contractor to each CI and its subordinate parts and assemblies. The part number of a given part is changed whenever a non-interchangeable condition is created.

Part number format is at contractor option and a wide variety of formats are employed. The standard constraint within the defense industry had been a limitation to no more than 15 characters including dash numbers. However, with the increasing use of commercial items that are not so limited, MIL-STD-2549 and many current systems accommodate 32 characters. Some contractors employ a mono-detail system in which one part is detailed on one drawing, and the drawing and the part number is the same. For practical reasons, some employ a multi-detailing system in which the drawing number may detail several parts and assemblies. Others use tabulated mono-detail drawings in which a drawing includes several iterations of a part. In the latter two cases, the drawing number is a base to which dash numbers are assigned for discrete parts controlled by that drawing.

The significant criteria are as expressed in the principles above: The part number must uniquely identify the specific part and unless otherwise specified, all CIs including parts, assemblies, units, sets and other pieces of military property are marked with their identifiers. **[Detail: 3.6.4, Activity Guide: Table 3-11][Reference: MIL-STD-100, MIL-STD-129, MIL-STD-130]**

c. Software Identifiers

For each CSCI, the software identifier consists of a name or other identifier and a version identifier, assigned by the developing contractor. The identifiers relate the software to its associated configuration documentation

(software requirements specification, software design documents, etc.), revision and release date. The software and version identifiers are embedded within the source code, and are marked on media containing the software. A method is typically employed to display the identifier and version to the user of the software upon command.

In a structured analysis and design approach to software development, the contractor assigns identifiers (which are usually mnemonic in form) to the software units below the CSCI level.

Firmware is labeled on the device or, if the device is too small, on the next higher assembly. **[Details: 3.6.4, Activity Guide: Table 3-11]**

d. Serial and Lot Numbers

CIs are the address for effectivity of subordinate parts, and for the effectivity of changes to subordinate parts. This means that the effectivity of a part is expressed in terms of the range of serial numbers of the CI end item into which it is assembled.

Note: There are other ways of expressing the effectivity, particularly in commercial industry, but whether lot, block, FY contract, date or other term is used, it must translate as closely as possible to which serial numbered CIs will have the part installed.

There are also several kinds of related serial numbers that are employed in a CI production phase. The Government normally identifies the serial numbers to be affixed by the contractor on Government designated deliverable CIs. Government serial numbers are in a variety of formats depending upon the type of equipment and the policy of the acquisition command. The issuance of Government serial numbers should be avoided where the contractor has an acceptable process for assigning unique serial numbers. Among other impacts, it increases Government administrative expenses in maintaining serial number block assignment logs for numbers of items (and for multiple suppliers of those items) for the Government inventory.

Contractors assign serial numbers (sometimes referred to as shop numbers) to units in production. All engineering, manufacturing and quality data will refer to the shop numbers. These shop serial numbers may or may not correspond directly to the serial numbers to be marked on parts or nameplates (delivery numbers), because for various reasons the shop units may not complete the manufacturing process in sequence, or some units in the flow may be sent to another customer. (Example: Two out of every three units of a system are supplied to the US Army, but the third unit is supplied to a foreign Government under a foreign military sale (FMS) contract.)

Where impractical to serialize individual units, because of quantity or composition of the part or material, lot numbers are employed to identify a group of identical parts. Typically lot numbers are employed for subordinate parts below the CI level, but occasionally, they are appropriate at the CI level, as for example with rounds of ammunition. The lot numbers are controlled and are subject to the same constraints as the serial numbers.

The important factors, in evaluating a contractor's system of item identification is that:

- There is an effective process for controlling the effectivity of parts by serial number (either shop number or delivery number)
- A comprehensive cross-reference is maintained between the shop number of an item and its delivery serial number, or for lot-controlled items, between the manufacturing lot and the delivery lot.

[Details: 3.6.4, Activity Guidelines: Table 3-11]

3.6.4 Item Identification Activity Guide

Table 3-11 provides details about item identification, including hardware, software and firmware.

Activity Guide: Table 3-11. Item Identification

Identifier Element	Definition/Requirements
Item Identifiers	
Military Nomenclature	• Contract must specify items or types of items to be nomenclated • Nomenclature requested from Government: in accordance with specified requirements[8] - Contractor assigns nomenclature in accordance with guidelines - Government approves nomenclature • Nomenclature is revised when necessary to account for a non-interchangeable condition
Part/Item Identification Number (PIN) **[Ref: MIL-STD-100]**	• Uniquely identify the item (when combined with the item's design CAGE code) **[See Table 3-10]** • All CIs, parts, assemblies, units, sets • PIN is the same as, or contains, drawing or other design document number (Note: This is a DoD-peculiar requirement that is not always the practice commercially) • Assigned by developing contractor • Changed (e.g. new dash number) when part is modified and a non-interchangeable condition is created
Serial and Lot Numbers (Product tracking identifiers)	• Uniquely identify an individual unit or specific group of units of an item (when combined with the manufacturer's identifier, eg., CAGE code, and the basis for serialization -- product-tracking base identifier. • When applied to CIs, are the basis for effectivity of subordinate parts • Government may designate serial numbers for deliverable CIs.[9] If no serial numbers are provided by the Government, the contractor will serialize each delivery unit according to his own system and convention. • Serial and Lot numbers are unique, consecutive, and non duplicating for a specific nomenclature or part identifier. - The original serial number of a unit/item/CI is not changed even when a change affecting interchangeability may require rework and re-identification. - Once assigned, serial numbers and lot numbers are never re-used for the same item. This rule applies to all types of serial numbers including delivery serial numbers and shop numbers as well. - It applies to lot numbered items to the extent practicable; if rework occurs by lot, in different lots than original manufacture, this rule is may be broken with the understanding that traceability to the original lot must be recorded.. - There should never be two items with the same part number and the same serial number produced by the same manufacturer. • Serial and Lot Numbers must be assigned against a non-changing base, known as a product tracking base-identifier.
Software/Firmware Identifiers	
Software Identifier	• Each CSCI shall have an identifier consisting of a name or number. It uniquely identifies the software when combined with the CAGE code or name of the company that developed it. • Each Version of the Software CSCI shall have a version identifier supplementing the software identifier • Software units, at and below the CSCI level, are identified using developing contractor convention, typically the conventions of the software language in which it is written
Firmware Identifiers	• Where both the hardware device and the embedded code are documented and controlled via the same engineering design document (drawing), the PIN for the device with code embedded identifies the firmware • Where the hardware device and the software to be embedded are documented and controlled separately, The device is identified by a PIN and serial number; the embedded software is identified as a CSCI

[8] MIL-STD-2549 lists the following sources: AFR 82-1, AR 70-50, MIL-STD-1464(AR), MIL-STD-1661(OS), MIL-STD-1812, MIL-STD-196, MIL-STD-787, NAVMATINST 8800.4.

[9] One method used on avionic equipment is to assign a series of three or four digit code letters/numbers to each fiscal year contract as a prefix for the sequential serial numbers to be assign to each unit of the items to be delivered. Air vehicles normally have a block of serial numbers assigned for each contract.

Activity Guide: Table 3-11. Item Identification

Identifier Element	Definition/Requirements
Hardware Marking and Labeling	
Items with assigned Nomenclature, Nameplated Items	• Contain the following identification information on their nameplates: - Nomenclature - Design Activity CAGE code and name - Part Number - Serial Number (Normally applicable; Lot Number if Serial Number is not applicable) - Manufacturer - Acquiring Government Activity - Contract Number under which it is acquired - National Stock Number, if applicable - Bar-coding, if specified, typically containing NSN and selected information above such as part and serial numbers
All Items large enough to legibly mark	• Design CAGE code (or other industry source identifier, if applicable) • Part Number • Manufacturer (CAGE code or name) • Serial or Lot Number, if applicable • Standard Number (MIL or commercial) if applicable
Small items	• Reference designator (on part or adjacent to it, as on a circuit board) relating the item to a documented record, or as in the case of electronic components, to an element on a schematic diagram • Striping, and or color coding, as on resistors and capacitors and other components, which indicate their values and tolerances according to industry standards
Software Marking and Labeling	
Software identifier and version identifier	• Are embedded in the source code for the CSCI • Means are provided to display identifiers for installed software to user upon software initiation or upon specific command • In mission critical situations, identification of the correct software version may be verified as part of system self-check; as well as during system test following equipment repair or maintenance.
Software media identifiers	• Each software medium (for example, magnetic tape, disk) containing copies of tested and verified software entities is marked with a label containing, or providing cross-reference to, a listing of the applicable software identifiers of the entities it contains. • Media for deliverable CSCIs are labeled with the Government contract number, the CAGE and CSCI software identifier, the CPIN (if any), and the media number (for example, 1 of 2, 2 of 2) if there are multiple units per set and copy number (Copy No. 1, 2, etc.) of the medium or media set (if there is more than one copy being delivered).
Firmware Marking and Labeling	
Non-reprogrammable	• PIN representing the device with software embedded is marked on device, or if device is too small on an adjacent assembly
Programmable	• PIN of device (without software) and serial number of device, if applicable, is marked on the device • For software labeling, see “Software identifier and version identifier” above. Device marking does not change when software is loaded or reprogrammed.

3.7 Engineering Release

3.7.1 Engineering Release Concepts

Engineering release is an action that makes configuration documentation available for its intended use and subject to the contractor's configuration control procedures.

Configuration documentation that requires Government approval is subject to Government configuration control. The contractor's engineering release process must prevent all engineering releases related to a class I change to a Government approved document from being released until the Government has approved the class I change. **[Details: Section 4]**

Acquisition program managers should ensure that both contractors and Government activities follow engineering release procedures which record the release and retain records of approved configuration documentation (engineering release records). These records provide:

- An audit trail of CI documentation status and history
- Verification that engineering documentation has been changed to reflect the incorporation of approved changes and to satisfy the requirements for traceability of deviations and engineering changes
- A means to reconcile engineering and manufacturing data to assure that engineering changes have been accomplished and incorporated into deliverable units of the CIs.

[Details: Activity Guide: Table 3-12. Engineering Release Record Content and Functional Capability]

It is probable during development that contractors would release several, progressively more detailed versions of specifications and drawings to their various functional areas or integrated product teams or to the Government (for technical reviews, progress reports). Configuration documents that require formal submittal to the Government for approval [Refer to Section 7] may be at an advanced revision level (Revision "G," for example) at the time of initial submittal. Under no circumstances is it prudent for the Government to ask a contractor to make his initial submittal of a document the "no-change" or initial revision, when it is not. By doing so, traceability to information that may become important at some future time could be lost. An additional liability is that the Government could incur a significant cost to have the drawings redrawn at the "no-change" revision, and the resulting documents would duplicate the identifiers of documents already in existence.

Detail design documents under the contractor control must be kept current with all changes/modifications and releases including changes occurring as a result of test activity. The record of prior release and use history of configuration documentation represents the developmental history of the CI and may be needed to support cost trade-offs and the rationale for changes to design constraints. Release records should indicate superseded as well as superseding requirements at least until superseded configurations no longer exist. Superseded requirements then may be retained as historical information.

All approved Class I and II engineering changes released for production are identified by change identifiers. The change is documented and released prior to formal acceptance of the deliverable unit in which the engineering change is first installed. The contractor's release process should verify the approval/concurrence status of each Class I/Class II change prior to the release of the related documentation for use in the generation of deliverable units. The release process and released documentation should identify engineering changes, and retain a record of superseded configuration requirements which are/were incorporated into delivered CIs.

Each approved Class I engineering change is incorporated into all units, or into complete blocks of units, within one mission, design, series or type, model, series of the CIs affected. Verification of the production incorporation of authorized engineering changes is accomplished for all CIs. Documentation of the actual released configuration for each CI at the time of its formal acceptance is retained in release records. This information is of particular importance, especially if there are warranties associated with the CI or its components.

Methods to ensure acceptable contractor engineering release systems include prior knowledge, through past performance, of the contractor's existing procedures, prior certification of the contractor's procedures; and a contractor's configuration management plan delineating his procedures.

During the operational support period, the Government will need design disclosure information on all CIs down to the level that will be supported by the Government. In addition, the Government may need additional design details prior to or at the end of Production, depending upon a number of factors such as:

- The need for continued support of operational items
- The type of specification to be used for re-procurement if re-procurement is anticipated. **[Details: Activity Guide: Table 3-13. Government Acquisition of Detailed Design Data]**.

In a CALS integrated data environment, selected information in a contractor's release record may be shared by the Government or downloaded to a CM AIS. The actual documents also may be downloaded (as raster images) to the JEDMICS data depository. Until the transition to these standard systems is completed, a variety of methods are being employed to populate the databases being used by the various services. There is currently no standard engineering release system used by all Government activities.

3.7.2 Engineering Release Activity Guides

Table 3-12 is intended to be used to evaluate a contractor's engineering release system from both a data content and a functional capability point of view. Acquisition reform has affected the degree of detailed design and engineering release information that the Government needs to perform its mission. **Table 3-13** addresses the various levels of detailed design data Government needs to acquire in a variety of circumstances.

Activity Guide: Table 3-12. Engineering Release Record Data Content and Functional Capability

Item	Elements of Data or Capability
Document Item	• Document Identifier • Title • CAGE number • Date of release • All released revisions • Date of release of each revision
Hardware Items CI elements	• CI identifier • Delivered CI serial numbers • Top assembly drawing number • CI specification identification number
Drawing elements	• Drawing number • Drawing title • CAGE number • Number of sheets • Date of release • All released change letters • Date of each change letter release • Change document number effecting each change letter release
Part number elements	• Controlling drawing number • Component part numbers released
Software items	For software items, the content of a CSCI Version Description Document (VDD) is the equivalent of a release record for hardware **[Table 3-9]**

Activity Guide: Table 3-12. Engineering Release Record Data Content and Functional Capability

Item	Elements of Data or Capability
Functional capabilities, i.e., Information that should be obtainable from a combination of release records and released documentation (including drawings and associated lists) during production phase	• The composition of any part at any level in terms of subordinate part numbers • All next higher part numbers (or next assembly numbers) in which the part is used • The composition of any CI in terms of component part numbers and subordinate CI identifiers • The composition of any CSCI in terms of units and subordinate CSCIs • The item part number and serial numbers, if serialized, on which any subordinate provisioned part is used • The CI identifier and CI serial numbers (effectivity) on which any subordinate provisioned, or to be provisioned, part is used • Identification numbers of class I changes which have been released for any specific serial-numbered unit of a CI • Identification numbers of all class II changes which have been partially or completely released for any particular part, including week of incorporation • The CI identifiers and CI serial numbers, or CSCI version numbers, which constitute effectivity of each class I engineering change • The specification or standard, part numbers or nomenclature of all parts including subordinate supplier parts • The specification document, specification control drawing numbers, or source control drawing numbers associated with any supplier CI. • All active contracts on which any part is to be delivered separately or as a part of an assembly.

Activity Guide: Table 3-13. Government Acquisition of Detailed Design Data

Purpose	Type of Data	Level
CI Re-procurement	Performance Specification(s) Technical Data Package	Down to CI level supported organically None Required
CI Re-procurement of identical items	Detail Specification(s) Technical Data Package	CI Complete for CI and Replaceable parts
Provisioned item re-procurement	Technical Data Package	Each provisioned item
Assume support previously provided by contractor	Technical Data Package	Complete for all items for which support is being assumed
CI Operation, maintenance and repair	Technical Manuals	Covering CI down to the level of replaceable parts and organically repairable parts

3.8 Interface Management

Another aspect of configuration identification to be considered during development is interface management, also referred to as interface control. Acquisition program managers responsible for new systems may have interfaces with other systems. Those interfaces constitute design constraints imposed on the programs. As the system is defined, other interfaces between system components become apparent. All of the interfaces between co-functioning items need to be identified and documented so that their integrity may be maintained through a disciplined configuration control process. In some cases a formal interface management process must be employed in order to define and document the interface.

3.8.1 Interface Management Concepts

Interfaces are the functional and physical characteristics which exist at a common boundary with co-functioning items and allow systems, equipment, software, and data to be compatible. The purpose of all interface management activity is that:

- The detailed design of each of the co-functioning items contains the necessary information to assure that the items, when individually designed and produced will work together (as the 115-volt plug to the 115-volt electrical outlet), and
- If either item needs to be changed for any reason, its performance, functional or physical attributes, that are involved in the interface, act as constraints on the design change.

During development, part of the contractor's design effort is to arrive at and document external interface agreements, as well as to identify, define, control and integrate all lower-level (i.e., detailed design) interfaces. **Figure 3-5** illustrates many (but not all) of the possible interfaces that may exist between systems and within a system. Interfaces include external interfaces with other systems, internal interfaces between CIs that comprise the system, and internal interfaces between CIs and other components of the system (e.g., personnel, non-developmental items (NDIs), facilities); as well as the interfaces between acquiring activities and supplying activities. In some cases, interfaces between two or more acquiring activities must be established (See Interface ❸ in Figure 3-5 and Table 3-15.), typically by means of a Memorandum of Agreement between service components or commands with in a service component that are acquirers of or users of interfacing equipment.

To understand how a particular interface should be defined and managed, it is necessary to categorize the interface in a number of ways:

- Contractual relationship - Are the items supplied by the same contractor or by different contractors? If different contractors, is there, or will there be, a contractual relationship (such as a subcontract or purchase order) between the parties to the interface?
- Customer relationship (Acquisition activity(ies) - Is the same acquisition activity responsible for both interfacing entities or are different activities or even services involved?
- Hierarchical relationship - Is the interface at the system, CI, assembly, or part level?
- Type(s) and complexity of technical interface attribute(s) involved - Is the interface a mechanical, electrical, electronic, installation, data, language, power, hydraulic, pneumatic, space, operating range, frequency, transmission rate, capacity, etc. (to name a few)
- Developmental status - Is one both or none of the interfacing items a non-developmental item (NDI)? Do the interfacing items require parallel design and development?

Categorizing the interface in this manner defines the context and environment of the interface, and enables the appropriate measures to be taken to define and control it. Each interface must be defined and documented; the documentation varies from performance or detailed specifications to item, assembly, or installation drawings, to interface control documents/drawings. Some interfaces are completely managed within the design process; others require specific types of formal interface management activity. The simplest and most straightforward approach that will satisfy the above objective should always be chosen. Extravagant and complex interface management activity, should only be undertaken when other methods are inappropriate.

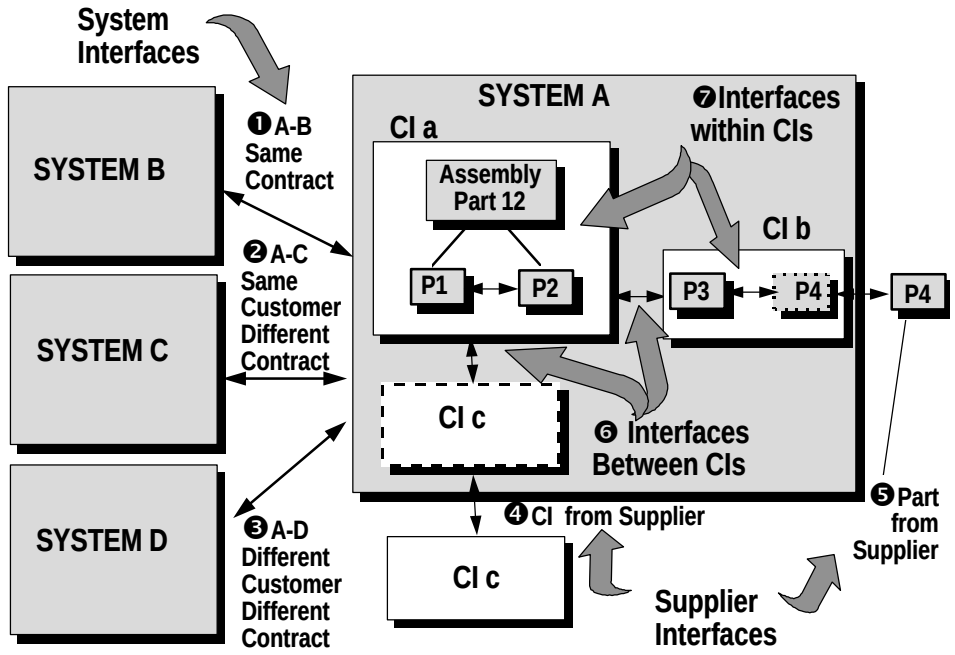


Figure 3-5. Understanding the Levels of Interface

Whether formal or informal interface management is employed, it is necessary that there be a legal responsibility on the part of the interfacing parties, since even the best intentioned technical agreements can break down in the face of fiscal pressure. If there is a contractual relationship, including a teaming arrangement, between two or more parties to an interface, there is already a vehicle for definition and control. However, where there is no contractual relationship, a separate interface agreement may be necessary to define the interface process and provide protection of proprietary information. When the agreement involves two or more contractors, it is referred to as an associate contractor agreement; when two or more Government activities are the parties to the agreement, a Memorandum of Understanding (MOU) is generally used.

Within an organization, and often with subcontractors, integrated product teams may be used to establish interfaces. Some interfaces must be defined through a formal interface management process involving interface control working groups (ICWGs). An ICWG is a specialized *integrated product team* comprised of appropriate technical representatives from the interfacing activities. Its sole purpose is to solve interface issues that surface and cannot be resolved through simple engineer to engineer interaction.

Once interfaces have been agreed-to by the parties concerned, they must be detailed at the appropriate level to constrain the design of each item and baseline the configuration documentation so that the normal configuration control process will maintain the integrity of the interface. Then it may be necessary to convene an ICWG or other mechanism on rare occasions to resolve change issues in a satisfactory manner. The Government is the arbitrator of issues that cannot be resolved by an ICWG or IPT, such as those issues which involve contractual issues requiring contract changes and agreement between different acquisition activities.

3.8.2 Interface Management Activity Guides

The following guides, **Tables 3-14, 3-15 and Figure 3-6** provide information concerning the appropriate selection of interface documentation and methods of managing the interface. Acquisition program managers can use the guides as an aid in establishing appropriate relationships with other acquisition activities responsible for interfacing systems or items, and for assessing the adequacy of contractors' interface management approaches.

Activity Guide: Table 3-14. Documentation Defining Interfaces

Document	Definition/ Guidance
a. System Performance Specification	• Defines system level performance and functional interfaces between systems, which act as a design constraint and configuration control mechanism. May reference an interface control drawing for interface specifics, in which case the ICD requirements are part of the System Specification
b. Item Performance Specification	• Defines performance and functional requirements for a CI. Specifications for each interfacing CI reflect the agreed-to interface parameters. This may be accomplished by reference to an ICD.
c. Item Detail Specification	• Defines performance, functional and physical requirements and design details for each CI. Specifications for each interfacing item reflect the agreed-to interface parameters. This may be accomplished by reference to an ICD.
d. Assembly Drawing	• Defines the physical interface between mating parts and subassemblies which comprise an assembly **[Further Detail: ASME Y14.24M]**
e. Installation Drawing	• Provides information for properly positioning and installing items relative to supporting structure and adjacent items, as applicable. May include dimensional data, hardware descriptions, and general configuration information for the installation site. **[Further Detail: ASME Y14.24M]**
f. Interface Control Document or Drawing (ICD)	• Depicts physical, functional, and performance interface characteristics of related or co-functioning items (CIs or components). An ICD is prepared to: - Establish and maintain compatibility between items having a common boundary - Coordinate and control interfaces between co-functioning systems through change control - Record and communicate design decisions to participating design activities • An ICD may control one or more of the following types of interface design requirements: - Mechanical, Electrical, Electronic, Hydraulic, Pneumatic, Optical - Operational sequence, system switching - Inter-operability (with allied systems) - Installation - Envelope, Mounting, and Interconnection - Other characteristics which cannot be changed without affecting system interfaces
g. Interface Requirements Specification	**[See Table 3-9, *Activity Guide*: Software Documentation]**
h. Interface Design Document	**[See Table 3-9, *Activity Guide*: Software Documentation]**
i. Control Drawing (Specification, Source), Vendor Item Description, Commercial Item Description, Purchase Description, etc.	**[See Table 3-3, *Activity Guide*: Order of precedence for Specifications, MIL-STD-100, ASME Y14.100]**

Activity Guide: Table 3-15. Interface Management Process Matrix

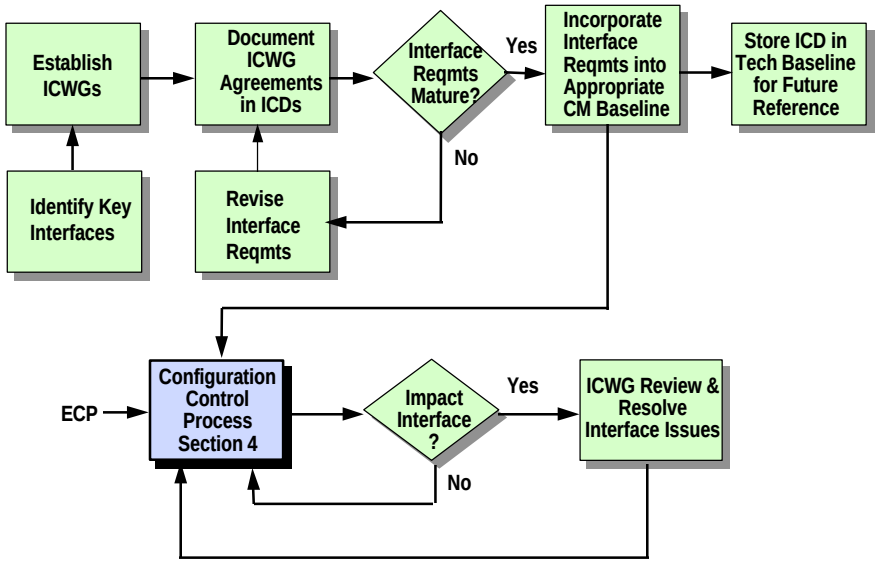
● Interface Illustrated in Figure 3-5			
Types of Interface (Figure 3-15)	**Developmental Status**	**Documents Defining Interface (Reference Table 3-14)**	**Process**
System A to System B: Same Contract, Same Acquiring Activity			
System/System • Performance • Physical • Functional	Case 1: A-Development B-Development Case 2: A-Development B-NDI or COTS[10] (in Production)	• ICD or IDD **(f. or h.)** • System A-System Spec **(a.)** • System B-System Spec **(a.)** • System A-System Spec **(a.)** • System B - Existing documentation **(a. to l., as applicable)**	• ICD/IDD may be used by contractor to document interfaces • Interface requirements included in System Spec(s) • Acquiring Activity approves System Specs establishing functional baseline for each system • Interface is maintained through change control to System and subordinate specifications • In Case 2, the System B interface is accommodated by System A.
System A to System C: Different Contracts; Same Acquiring Activity			
System/System • Performance • Physical • Functional	Case 1 A-Development. C-Development Case 2 A-Development. C-NDI or COTS (Production)	• ICD • System A-System Spec **(a.)** • System B- Spec **(a.)** • System A-System Spec **(a.)** • System C - Existing documentation **(a. to l., as applicable)**	**[See *Activity Guide*: Figure 3-6 for Process Flow]** • Associate Contractor Agreement (ACA) between Contractors A and C establishes Interface Working Group (ICWG) IPT • ICWG IPT develops ICD; approved by both parties • Interface requirements included in System Spec(s) • Acquiring Activity approves System Specs establishing functional baseline for each system • Interface is maintained through change control to System and subordinate specifications • System A interface accommodates known design of System C and is approved and baselined as above • System A contractor negotiates with System C contractor to receive (as a minimum) advance notification of change to system C • Interface is maintained through change control to System A configuration documentation.
System A to System D: Different Contracts; Different Acquiring Activity			
System/System • Performance • Physical • Functional	Case 1 A-Development B-Development	• ICD • System A-System Spec **(a.)** • System B- Spec **(a.)**	**[See *Activity Guide*: Figure 3-6 for Process Flow]** • Memo of Agreement (MOA) between Acquiring Activities, establishing Government Interface Management IPT, if deemed necessary • ACA between Contractors establishing ICWG IPT • ICWG IPT develops ICD; approved by both parties with contractual and performance issues adjudicated by Government Acquiring Activities via Interface Management IPT, as necessary • Interface requirements included in System Specs Acquiring Activities approve respective System Specs establishing functional baseline for each system • Interface is maintained through change control to

[10] NDI - Non Developmental Item; COTS-Commercial Off-The-Shelf. Integrating NDI and/or COTS products into a system presents special configuration management issues and concerns. **[See Appendix C.]**

Activity Guide: Table 3-15. Interface Management Process Matrix

● Interface Illustrated in Figure 3-5			
Types of Interface (Figure 3-15)	**Developmental Status**	**Documents Defining Interface (Reference Table 3-14)**	**Process**
			System and subordinate specifications. If there is impact to defined interface, coordination of companion ECPs takes place between contractors and via ICWG IPT and Interface Management IPT, as required
System A to CI c or CI b, Part 4: Subcontract or Purchase Order			
System/CI or Part from Supplier • Performance • Physical • Functional	Case 1 A-Development CI-Development Case 2 A-Development CI-Production, NDI or COTS	• Item Performance or Detail Spec **(b. or c.)** • Item Performance or Detail Spec, Specification Control Drawing, Vendor Item Description, etc. **(b., c., l. as applicable)**	• System A Contractor allocates requirements from System Spec to Item Spec • Item spec referenced as requirement of subcontract • Same as above • Item documentation cited in subcontract controls the interface
CI a to CIs b and c: Under One Contract			
CI to CI • Performance • Physical • Functional		• System Spec A **(a.)** • Item Performance or Detail Specs for each CI **(b. or c.)** • Installation Drawing **(e.)** or Interface Design Document **(h.)** if CSCI	• Contractor allocates requirements from System Spec to Item Spec • Installation Drawing or IDD governs design details at interface between the CIs
Assembly/Part interfaces within CIs a and b: Under One Contract			
Part to part within CI		• Assembly Drawing **(d.)**	• Contractor controls detailed design via applicable drawings

Activity Guide: Figure 3-6. Interface Management Process Flow



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SECTION 4
CONFIGURATION CONTROL

	QUESTIONS THIS SECTION WILL ANSWER	Para.
1.	What is the Configuration Control process and why is it necessary?	4.1
2.	What are the differences between Contractor and Government Configuration control practices?	4.1
3.	What is a Current Configuration Control Authority? A Current Document Control Authority; An Application Activity?	4.1.1.1
4.	When a document is under configuration control, does it mean that the Government must approve changes to it? How are contractor and Government approval requirements established?	4.1.1.2, 4.1.2
5.	Why do we classify engineering changes?	4.1.1.2, 4.1.2
6.	What are the functions of a Configuration Control Board?	4.1.1.3
7.	Why is effectivity important?	4.1.1.4
8.	What information is required to make intelligent configuration control decisions?	4.1, 4.2.1, 4.2.2, 4.3.1, 4.3.2
9.	What is an engineering change proposal? What does it contain? How is it processed?	4.2
10.	What is a deviation? What does it contain? How is it processed?	4.3
11.	Can ECPs and Deviations be prepared and submitted electronically?	4.2.1.2, 4.3.1
12.	What configuration baselines are subject to configuration control?	Section 3, 4.1

4.1 Configuration Control Activity

Configuration control is perhaps the most visible element of configuration management. It is the process used by contractors and Government program offices to manage preparation, justification, evaluation, coordination, disposition, and implementation of proposed engineering changes and deviations to effected Configuration Items (CIs) and baselined configuration documentation.

The primary objective of configuration control is to establish and maintain a systematic change management process that regulates life-cycle costs, and:

- Allows optimum design and development latitude with the appropriate degree, and depth of configuration change control procedures during the life-cycle of a system/CI.
- Provides efficient processing and implementation of configuration changes that maintain or enhance operational readiness, supportability, interchangeability and interoperability
- Ensures complete, accurate and timely changes to configuration documentation maintained under appropriate configuration control authority
- Eliminates unnecessary change proliferation

The span of Configuration control begins for the Government once the first configuration document is approved and baselined. This normally occurs when the functional configuration baseline (referred to as the requirements baseline in EIA/IS-649) is established for a system or configuration item. At that point, complementary Government and contractor change management procedures are employed to systematically evaluate each proposed engineering change or requested deviation to baselined documentation, to assess the total change impact (including costs) through coordination with affected functional activities, to disposition the change or deviation and provide timely approval or disapproval, and to assure timely implementation of approved changes by both parties. Configuration control is an essential discipline throughout the program life cycle.

Figure 4-1 illustrates a top-level activity model of the configuration control process. It shows the configuration control process divided into three segments which are detailed in **Figures 4-2, 4-3 and 4-4**, respectively.

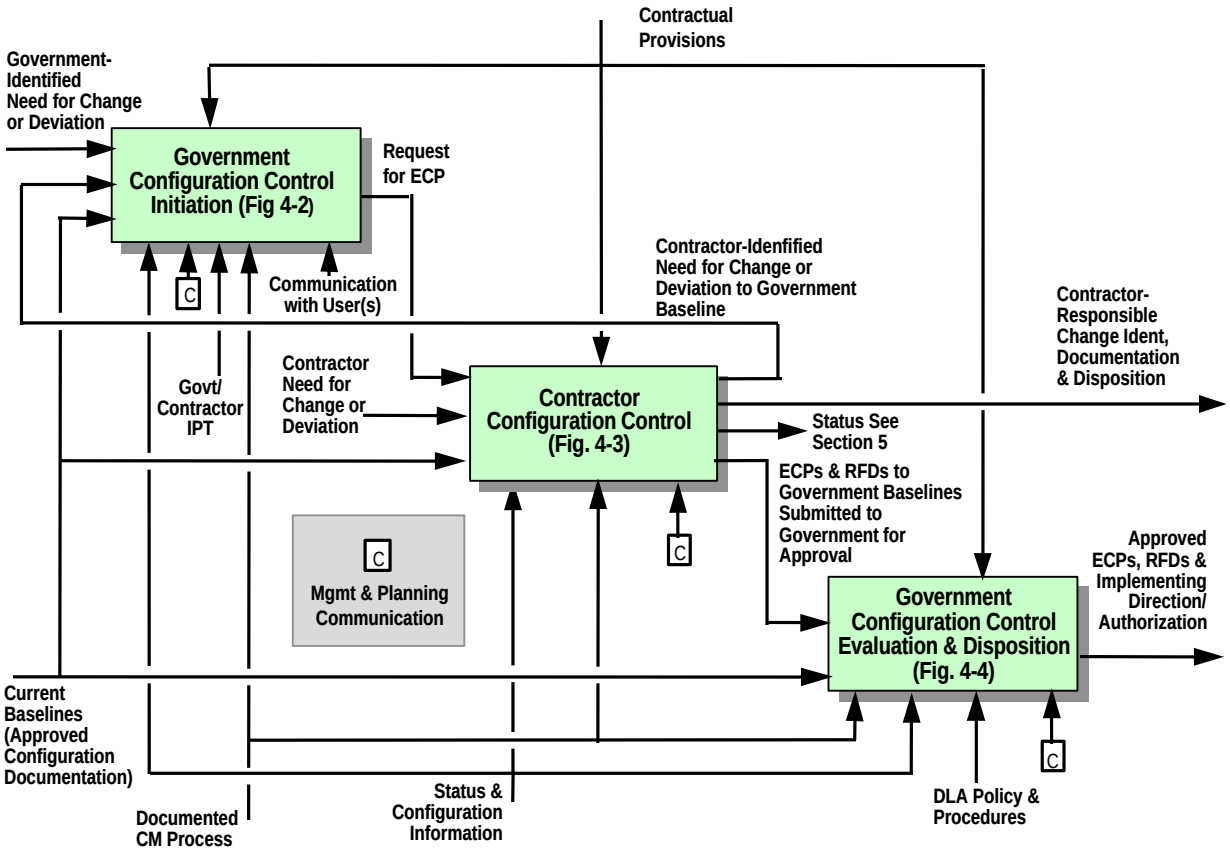

Figure 4-1. *Activity Model*: Configuration Control Process

The first segment, Government Configuration Control-Initiation, reflects the portion of the process prior to Government request for a contractor Engineering Change Proposal (ECP). This activity occurs:

- When the need for a change is originated by a Government activity (including field and operations activities)**[Details: 4.2.1.1]**
- As a result of input from the contractor that a Class I Change to a Government controlled baseline is needed **[Detail: 4.2.1.1]**
- After configuration documentation that will be affected by the proposed change has been approved and is incorporated in the current baseline controlled by the Government

Changes may be needed for a variety of reasons, such as to counter new threat, insert new technology, respond to technical and operational tests and evaluations, or correct problems. As shown in **Figure 4-2**, the Government activity responsible for configuration control confirms the need for change, sets thresholds for performance, cost and schedule for the proposed change, makes a determination that the change is technically achievable and affordable (based on current information and contractor[1] interface, where appropriate) **[Detail: Appendix G]**, and prepares a request for the contractor(s) to prepare an ECP. One of the most significant contributors to configuration control efficiency and effectiveness is clear and concise communication between the Government and the contractor prior to the formal request for ECP. Ideally this occurs in an integrated product team environment.

Figure 4-3, reflecting the second segment of **Figure 4-1**, models the contractor's configuration control process. Contractor configuration control is invoked as each item of configuration documentation is released by the contractor. Ultimately contractor configuration control is applied to the complete set of configuration documentation including Government baselined configuration documentation at the performance or detailed

[1] As stated in Section 1, the term contractor as used in this handbook also refers to a Government cognizant field activity who may be tasked to prepare an ECP

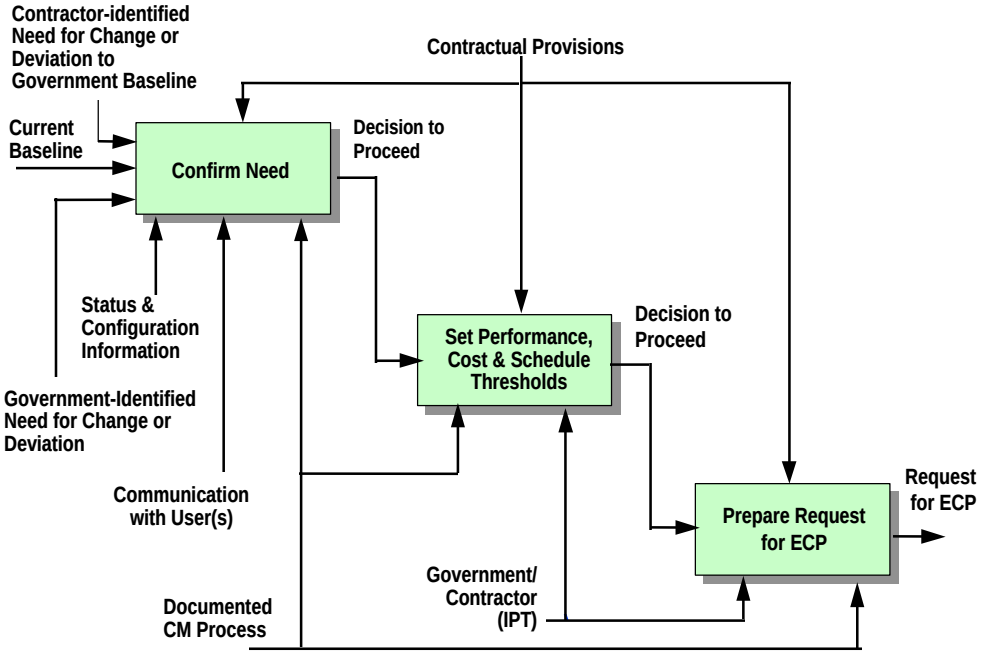

Figure 4-2. *Activity Model:* Government Configuration Control: Change Initiation

specification level, as applicable, and the design solution embodied in engineering models and drawings. The contractor responds to Government ECP requests and to internally generated requests for design changes or deviations (RFD). The contractor evaluates each proposed change or deviation request and documents its impact to the development and supportability of the CI, determines the applicable level of review and approval required, and ensures that a specific decision about the viability of the change is made by the applicable configuration

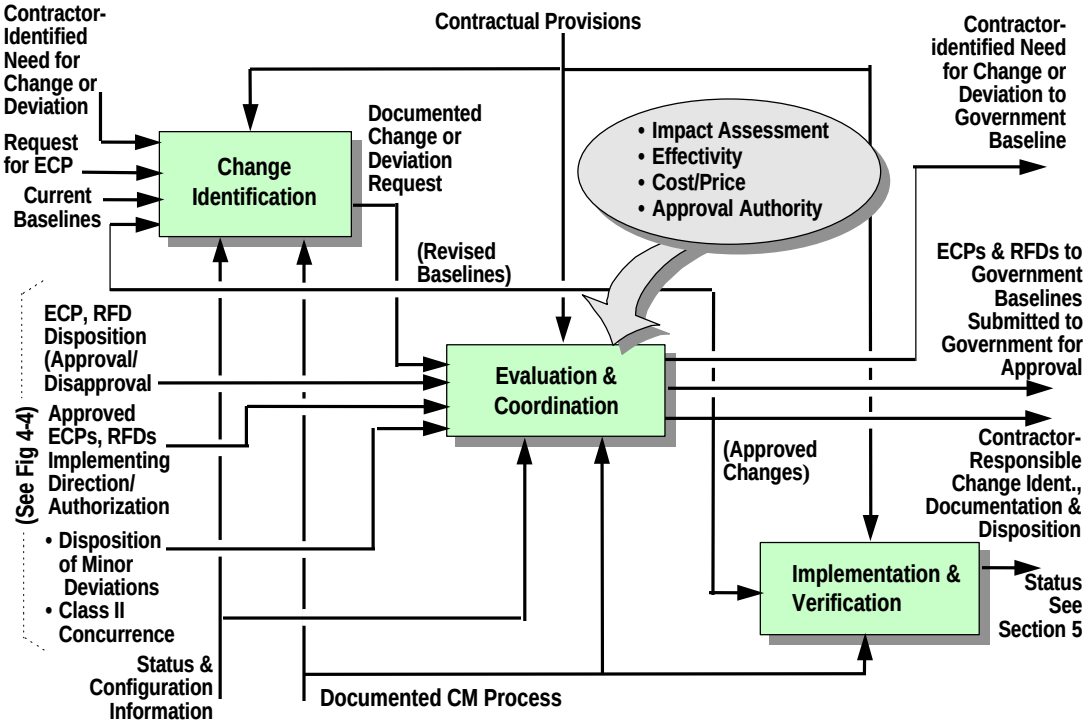

Figure 4-3. *Activity Model:* Contractor Configuration Control

control authority before it is implemented. ECPs and RFDs requiring Government review and/or approval are forwarded in accordance with contractual requirements. The change approval decision is made by the Government when:

- The change is to a requirement of a baselined performance level configuration document controlled by the Government, or
- A change to a configuration document controlled by the contractor has an impact on specified performance, supportability and other contractually specified requirements pertaining to the CI and documentation controlled by the Government.

The contractor makes the decision when the change is to items/configuration documentation for which it is the configuration control authority, provided those changes do not impact the Government's baselines.

Figure 4-4 models the third segment of **Figure 4-1**, covering the portion of the process concerned with Government review and disposition of contractor submitted ECPs and RFDs. It illustrates local Government representative review and concurrence with class II changes and minor deviations (where such action is contractually required) and its endorsement (or non-endorsement) of class I changes and major/critical deviations. The Government configuration control activity (typically a secretariat) prepares for the configuration control board by coordinating the proposed change with all affected parties, receiving technical concurrence and cost and schedule commitments, and by placing the change/deviation on the CCB calendar (in concert with its readiness and the urgency of the change). The CCB then reviews the proposal and the implementation commitments and either approves or disapproves them in accordance with the procuring activity's policy. As a result of the CCB decision, implementing direction is given, typically in the form of a CCB directive. Actions directed by the CCB include both contractual actions and tasking orders for Government activities, as applicable. In response to a CCB Directive, the Government contracting office prepares and negotiates a contract modification to authorize the contractor to proceed with implementation of the approved class I ECP or major/critical deviation.

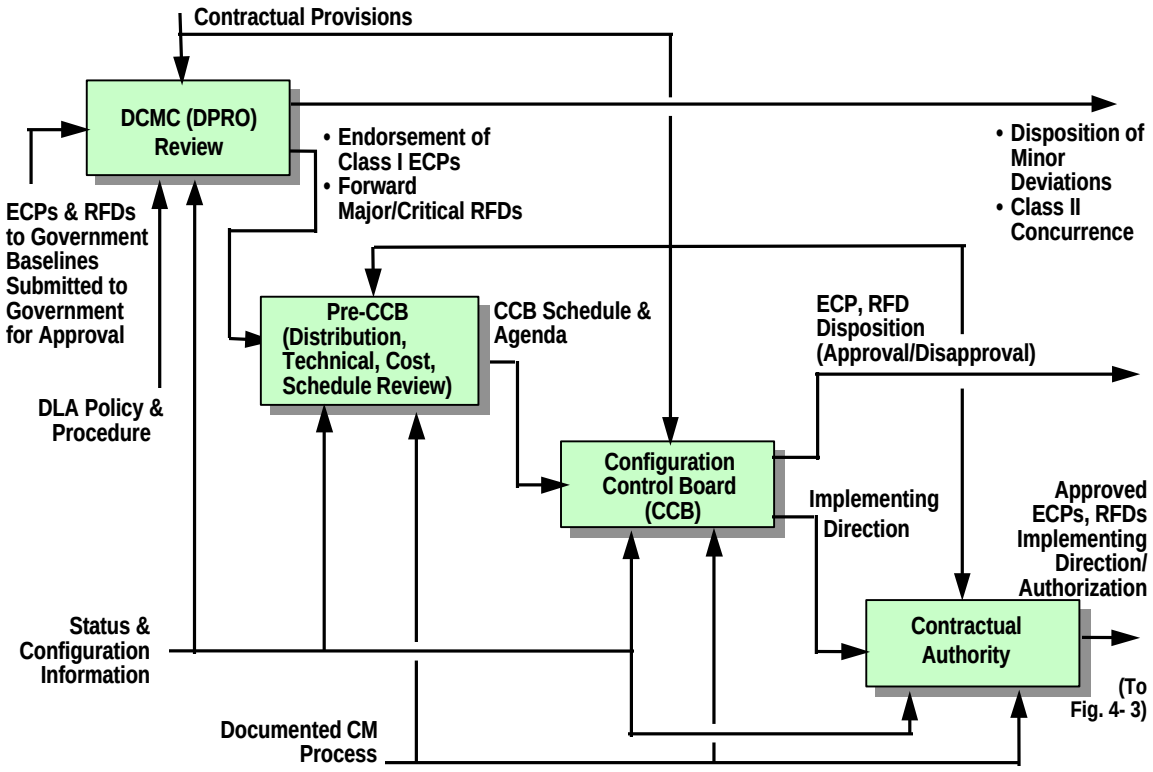

Figure 4-4. *Activity Model:* Government Configuration Control: Change Evaluation & Disposition

An effective, well defined configuration control process assures the government program office that all changes to government controlled baselines, no matter how small or seemingly insignificant, are reviewed by the applicable configuration control authority. Without an effective configuration control process the program office runs the risk of delivering CIs with configurations that:

- Are technically inadequate and fail to meet specified performance requirements
- Are not logistically supportable
- May be unsafe
- Result in wasted resources, and
- Do not provide an accurate historical record as a basis for future change.

4.1.1 Configuration Control General Concepts and Principles

As described in 4.1, configuration control of baselined configuration documentation is an integrated change management process including both performing activity (generally a contractor) and tasking activity (generally the government) responsibilities for change preparation, justification, evaluation, coordination, disposition, and implementation. Through the configuration control process, the full impact of proposed engineering changes and deviations is identified and accounted for in their implementation.

The configuration control process evolves from a less formal process in the early phases of a program to a very disciplined and formal process during the EMD and P,F/D&OS phases **[See Figure 1-1 and 2-5]**. In the concept exploration phase the configuration control process is employed in support of systems engineering to make sure that the correct version of documents which communicate technical decisions and definition of pertinent study parameters are disseminated and used by all personnel. In addition, the process makes affected parties aware that a change is being developed and enables them to provide pertinent input.

In the Program definition and Risk Reduction Phase, when the program definition documents are being developed, the configuration control process is also less formal. As part of the systems engineering control process in this phase, there may be several requirements definition baselines established for convenience in assuring that all program participants are “on the same page.” A configuration control procedure is helpful in this phase for the review and coordination of changes to the evolving system level specifications. It can also serve to maintain the Government/Contractor information interchange efficient and manageable by providing:

- The identification, documentation, dissemination and review of changes
- Appropriate versioning of files and revision of documents
- A release process to assure that each revision/version reflects the applicable changes

During EMD and P,F/D&OS phases, a formal configuration control process is essential. The informal document change control that was practiced during Phases 0 and I is insufficient for Phases II and III. As the product is being developed and produced in these phases, configuration control focuses on the documentation defining performance, physical and functional characteristics and the configuration of the product. Configuration control is a management process using contractual (Government) and internal (contractor) configuration baselines as references for managing change. Within this context, however, there are several configuration control complexity levels. When viewed at the macro level, described by the activity models (Figures 4-1 through 4-4), the process:

- Addresses the baseline documentation
- Determines which documents are impacted
- Proposes a change covering the impacts to all affected elements, and
- States when, where, and by whom the documentation will be updated and the change will be incorporated in the product and in all supporting elements.

While this top-level macro view appears simple and straight forward, a micro level view of the configuration control process can be considerably more complex. The micro view reveals the process layer dealing with what must be done to change each affected element, and thus with a wide variety of considerations such as data rights; approval authority, document custodians; design, release, production, installation and testing organizations; contractual and interface relationships. **[Details: 3.3, 3.4, 3.7, 3.8, Section 7]**

To effect change to a product, the first step is the revision of the documents defining the product. The concepts discussed below, some of which are introduced in **MIL-STD-2549**, facilitate accomplishing this step, using automated tools such as a CM AIS. This handbook views these concepts from both program management (macro) point of view and the document control (micro) point of view expressed in MIL-STD-2549.

4.1.1.1 Current Authority. On the micro level, if an ECP proposing a change to a product impacts several documents, the change proposal, evaluation, and implementation must consider:

- Who is the contractual authority to approve an ECP? This is the product configuration control authority
- Who has the right to approve revision of each document affected by an ECP? This is the current document change authority.
- Is a related ECP required from a document change authority organization before the configuration control authority for the product can approve an ECP for the product?
- Are there other Government or industrial activities involved because the product has multiple users? These are application activities. Is one designated the lead application activity?

a. Configuration Control Authority. The contractual configuration control authority approving the implementation of a change to a product (system/CI) may initially reside with a contractor or with the Government. It may transfer from the contractor to the Government, or may continue to reside with the contractor throughout the life cycle of the CI. This authority is technically responsible for the performance of the product as well as fiscally responsible for funding changes to the product.

The level of Government configuration control is generally determined as part of CI selection. **[Details: Refer to 3.3.1, 3.3.2]** During an acquisition program, it is the levels at which the Government specifies, contracts for, accepts and plans to logistically support the individual components of a system or CIs. Government configuration control always addresses the functional baseline and the allocated baselines established for lower level CIs whose specifications have been issued by, or approved by the Government **[Details: Refer back to 3.5.2]**. Similar and related contractor configuration control practices also apply to CIs and component parts below the level of Government configuration control.

The contractual configuration control authority addresses the total set of documents that are baselined for the product controlled by that authority for a specific contract. This authority can be the Current Document Change Authority (CDCA), described in b. below, for individual documents which require change (e.g., a system or CI performance specification). If it is not the CDCA for a given document, it does not have the authority to approve a proposed change to that document, and therefore must solicit ECP approval from the applicable CDCA, or select an alternate design.

b. Current Document Change Authority. The concept of current document change authority (CDCA), a term established in MIL-STD-2549, is an expression of a relationship which has always existed. Before the need to manage configuration documentation with an automated information system this concept was not clearly articulated but was embodied in the terms “Originating Design Activity” and “Current Design Activity.” **[Ref: MIL-STD-100]** However, the definition of those terms refer to specifically to design documents, e.g., engineering drawings, as opposed to all documentation, and they also include custodial as well as design responsibility.

The CDCA on the other hand, pertains to specifications or any other type of document and is independent of the organization that physically maintains and stores the document. The CDCA is the organization that has the decision authority over the contents of the document, reflecting proprietary or data rights to the information that the document contains. The CDCA may be a Government activity or a contractor, and the authority may be transferred. However there is only one CDCA for a document at a time.

The scenarios in the box on the next page illustrate the logic of CDCA designation:

Scenario

1. An Engineering and Manufacturing Development (EMD) phase contract: the contractor develops a CI to a Government-approved performance specification; design documentation is in contractor format, and the Government has not contracted to control the product baseline (PBL) or order a technical data package (TDP):
   - The Government is the configuration control authority for the product and CDCA for the Performance Specification
   - The contractor is the CDCA for the design documentation.
2. An EMD contract similar to 1, except the Government establishes the PBL and acquires the TDP:
   - The Government is the configuration control authority for the product and CDCA for the Performance Specification
   - The contractor is the CDCA for the design documentation
   - The Government becomes the configuration control authority for the detailed design upon establishment of the PBL
   - The contractor continues as the CDCA for the design unless the Government has contracted for and takes delivery of the original drawings. In the latter case, the Government or its agent becomes the current design activity (adds Government CAGE Code) and CDCA.
3. A production phase contract, where EMD was to Scenario 1: the Government orders the TDP at the end of production to guarantee long term support and to reprocure the item and/or its spare parts from sources other than the original manufacturer:
   - The Government is the configuration control authority for the product and CDCA for the Performance Specification
   - The contractor is the CDCA for the design documentation
   - At the end of Production, the contractor delivers a TDP in accordance with the CDRL This may be a copy or the original.
   - If the original of the TDP is submitted for approval, and a Government PBL is established, the Government becomes the configuration control authority/CDCA for the design from the point of TDP approval (except for those documents and designs which are the property of others)
   - If copies of the TDP are submitted for information, the Government does not have approval right to configuration changes that are approved by the contractor after completion of production:, the contractor remains the CDCA for the design.
4. An Engineering and Manufacturing Development (EMD) phase contract: the Government contracts for a contractor to develop a CI to a Government-approved performance specification; Government is to be the design activity (i.e. Government CAGE code) and the Government orders a technical data package (TDP) and will establish and control the product baseline (PBL):
   - Government is the Configuration control authority and the CDCA for all the specifications and design documents, except those designs and items that are the property of others, throughout the life of the document.
5. An Engineering and Manufacturing Development (EMD) phase contract: the Government contracts for a contractor to develop a CI to a Government-approved performance specification; Contractor is to be the design activity (i.e. Contractor CAGE code); the Government will establish and control the product baseline (PBL), orders a technical data package (TDP) for approval, and delivery of drawing originals::
   - The Government is the configuration control authority for the product and CDCA for the Performance Specification
   - The contractor is the CDCA for the design documentation
   - The Government becomes the configuration control authority for the detailed design upon establishment of the PBL
   - The Government or its agent becomes the current design activity (adds Government CAGE Code) and assumes the role of CDCA for the design documents, except those designs and items that are the property of others, upon approval of the TDP and delivery of the original drawings.
6. Contractor developed item with his own funds and claims proprietary rights (commercial item):
   - Contractor is the configuration control authority for the CI and CDCA for the configuration documentation, over the entire life of the CI.
   - Government is an Application Activity

c. Application Activity. There may be multiple configuration control authorities for a product with more than one user; each being a configuration control authority for a given contract. If the configuration control authority for one contract is the CDCA for the system/CI Performance specification for the product, then the other configuration control authorities are considered application activities because their authority extends only to the use of the product and its documentation. They cannot authorize change to either, but they may participate in the change control process if asked for input by either the configuration control authority that is the CDCA, or by the Government lead application activity.

It has always been desirable for the contractor for an item to deal through a single Government focal point for the coordination of changes. Often this has not been the case. Each Government activity typically considered their authority paramount and did not always recognize that there were multiple application authorities. As multiple use of items continues to proliferate, there must be a simple logical method of distinguishing control authority from use authority, and of communicating and coordinating changes that may have multiple use impact. The following Application Activity designations are used for this purpose in MIL-STD-2549:

- Application activity (AA) - a user of a document who is not its CDCA
- Government lead application authority (GLAA) - the Government acquisition activity that has been designated as the lead for the acquisition of the item. When assuming this role, the GLAA consolidates recommendations from all the Government application activities and is the single point of contact within the Government for coordination with the Government/Contractor CDCA.

4.1.1.2. Change Classification. Change classification is a shorthand method for indicating the change processing and/or approval method. ECPs required to be submitted to the Government are classified as either class I or class II. A class I ECP is approved by the Government's Configuration Control Board and authorized with a contract modification. A class II change, on the other hand, is typically reviewed for concurrence in classification by the local government representative, unless otherwise specified in the contract[2]. Unless a government representative is identified in the contract (normally a person from the procuring activity), the Contractor (or ECP originator) is responsible for assigning change classification. The criteria for ECP classification is now detailed as part of the change classification data element definition in MIL-STD-2549. **[Detail: Activity Guide: Table 4-2]**.

In performance based acquisition, the definition of both class I and class II changes have been modified to reflect application only to changes that impact Government approved (baselined) configuration documentation. Changes to contractor baselined documentation must all be reviewed by the contractor to determine if they also impact government performance requirements and support activities.

The classification factors apply only to engineering changes proposed to approved configuration documentation. Although adding a statement of work task (such as an environmental impact analysis) may require a contract modification and could result in increase costs to the government, it is not considered a class I engineering change because neither the design nor the configuration documentation is affected. **[Detail: Activity Guide: Table 4-2]**

In classifying a change, consideration must be given to more than the form, fit , function or interface characteristics of the CI itself. All of the ECP classification factors **[Refer to Activity Guide: Table 4-2]** must be considered prior to classifying an ECP. The factors include many support, operational, and training considerations. For example, a proposed design change to an electronic circuit card would not be a class I change by itself if the contractor is CDCA for the card's documentation. But if the redesign requires a change to automatic test equipment or support software for which the Government is responsible, the change must be classified as a class I ECP and processed accordingly. It should be noted that class I changes of this type which are mistakenly classified as class II or considered within the contractor's CDCA responsibility, could result in significant operational use and/or logistic support problems and increased costs to the Government.

All applications of the affected CI must be considered when classifying a change, e.g., ECPs initiated against a CI being manufactured by more than one contractor, a CI which has multiple applications or is used by more

[2] Class II concurrence authority has been delegated to contractors in many cases as the result of single process initiative (SPI) proposals. However, Class II approval authority can only be delegated to contractors for documents for which they are the CDCA

than one tasking (application) activities. The classification criteria must be applied to all of the CI applications via coordination between the affected activities.

4.1.1.3 Configuration Control Board (CCB). Government CCBs are established for major acquisition programs. (Contractors also employ a similar process for their internal configuration control.) CCBs are usually comprised of the joint command or agency body chartered to act on class I ECPs and requests for major or critical deviations. The program manager is normally the chairperson of the CCB and makes the decisions concerning all changes brought before the CCB. The CCB is a program management process used by the program manager to ascertain all the benefits and the impacts of the change before the decision is made. Once the CCB Chairman has rendered a decision, a CCB directive, or equivalent letter/memorandum, is signed by the CCB chairperson, directing the appropriate implementing actions to be completed.

a. CCB Authority. Each CCB has a limited authority to approve changes based on the following factors:

- Authority may be limited by a higher level CCB, where there is a hierarchy of CCBs on a complex project
- A CCB, within an organization that is not the CDCA for a document, does not have the authority to approve a change to that document.
- If the CDCA is the organization that proposed the change to the CCB, the CCB approves the funding and incorporation of the change to the product, while the CDCA approves the change to the document.
- If an organization that is not the CDCA for a document proposes a change to a CCB organization that is also not the CDCA for the document (i.e., an AA CCB),.the AA CCB does not have the authority to approve the change.
- AA CCBs may review proposed changes and make recommendations to the CDCA. The AA CCB can decide only to adopt (or not adopt) a change that is approved by the CDCA.
- CCB approval of an ECP must sometimes be withheld pending approval of specific document changes by the CDCAs for those documents
- CCB approval may sometimes be withheld pending receipt of user positions from all Government AAs indicating that they will adopt the change. As stated in 4.1.1.1.c, multiple AA positions should be coordinated by a GLAA.

b. CCB Membership. The membership of the CCB is normally comprised of the key functional or subject matter experts from the Government organization, e.g. Integrated Program Team (IPT). The members are responsible for advising the CCB chairperson. Other functional personnel may be included, as may be dictated by the change and/or program requirements including representatives from other DoD services (for joint service programs) and other countries (for multi-national programs). CCB membership should consist of, but not be limited to representatives from logistics, training, engineering, production management, contracting, configuration management and other program related functional disciplines. CCB membership is maintained by CCB charter.

c. CCB Charter. CCB charters are normally approved through the government procuring activity official administrative channels. All CCB members must be present at each CCB meeting and should be familiar, from their functional perspective, with the changes being considered. CCB members are obligated to make their position(s) known to the chairperson; and ultimately to signing the CCB directive/order (when required) noting their agreement or disagreement with the decision. To sign the CCB Directive (CCBD), a person must be the primary (or alternate) CCB member designated by the CCB charter.

d. CCB Operating procedures. The procuring activity's CM office should publish procedures for CCB operation so that all members understand its importance to the acquisition process. A CCB secretariat schedules meetings, distributes agendas, records CCB decisions, and distributes minutes and directives to parties who are assigned implementing action(s) or have a need to know. The CCB operating procedures should also define target processing times for ECPs to assure timely staffing, approval and implementation.

4.1.1.4 Effectivity. The effectivity of an ECP identifies the quantity or range of CIs which are to be changed, including both production incorporation and retrofit of delivered CIs. The establishment of ECP effectivity requires the procuring activity to consider such factors as the following:

- **Urgency** - Correcting a deficiency involving personnel safety may be significant enough to override all other considerations, even concurrent support. If operating limitations are placed on equipment pending resolution of a safety issue, operational effectiveness can be severely restricted

- **Inventory** - Parts and materials on hand must be considered; a decision based on cost and operational trade-offs must be made either to use existing materials to depletion, or to scrap current inventory. This applies to both contractor inventory as well as Government stocked spare and repair parts

- **Configurations** - One of the key configuration management objectives is to minimize the number of different CI configurations that must be simultaneously supported, particularly if the different CI configurations require different or updated operational software, support equipment, support software, spares, training or publications. Since all existing CI configurations cannot often be updated simultaneously, careful consideration must be given to either delaying or accelerating the incorporation of the change to minimize the impact. Setting effectivity to a future defined block of the CIs may be one solution. Combining or packaging a number of software changes into the next version may be another, etc.

- **Lead Time** - There are many lead times to consider when identifying the effectivity for a change. The manufacturing/procurement lead times necessary to complete non-recurring design effort, procure parts and materials and incorporate the change both in production and/or retrofit must be considered. The administrative lead time required for processing the change for approval is also paramount. The Government and contractor bear a responsibility to avoid delay in change processing particularly when there are large quantities of the CI in production and in the operational inventory that must be retrofitted. The cost of delaying a decision may result in additional obsolete configurations being delivered that will have to be retrofitted. Often, the recurring cost of replacing components in production is merely the substitution of one assembly of equal or lower cost for another; whereas retrofitting the same change involves the cost of both assemblies, as well as the additional cost of disassembly and replacement.

- **Timing** - The effectivity may need to be selected so that a given operational capability will be available at a given time or for a specific event such as a planned deployment of forces or a training exercise.

4.1.2 Configuration Control General Activity Guide

Table 4-1 provides an activity guide for the evaluation of a configuration control process.

Table 4-1. *Activity Guide*: Configuration Control Process Evaluation Checklist

✓	Criteria
	1. Documented Process
	a. Does the contractor have a documented Configuration Control process?
	b. Does the contractor follow his documented process?
	c. Are contractor personnel from all disciplines involved in the process informed and knowledgeable about the procedures they are supposed to follow?
	2. Change Identification and Documentation
	a. Is each ECP and Deviation assigned an appropriate identifier?
	b. Are requests for change classified to identify the appropriate change approval authority?
	c. Do the contractor's change classification rules match or clearly map to the Government's change classification rules (see table 4-6)?
	d. Are the criteria for determining what must be submitted to and approved by the Government clear and unambiguous?
	3. Engineering Change Proposals
	a. Are ECPs documented sufficiently to permit an informed evaluation and assessment of the impact of the ECP?
	b. Do ECPs clearly define the proposed technical approach and the proposed effectivity? Does the effectivity include production and retrofit, if applicable?
	c. Are proposed ECPs coordinated with and evaluated by representatives from all impacted areas?
	d. Does the contractor employ a Configuration Control Board (CCB) or electronic equivalent?
	e. Are all technical, support, schedule, and cost impacts identified before the CCB decision is made?
	f. Is the CCB a non-voting board? Do the members have the opportunity to document their concurrence or non-concurrence prior to board decisions?
	g. Does the CCB chairperson have sufficient authority to commit the resources necessary for change implementation?
	4. Change Implementation and Verification
	a. Does the contractor implement approved changes in accordance with documented direction?
	b. Is change implementation verified? Is the verification sufficient to ensure CI consistency with its documentation?
	c. Are changes to all affected commodities tracked and verified?
	5. Requests for Deviation
	a. Are RFDs documented sufficiently to permit an informed evaluation?
	b. Are RFDs categorized/classified (e.g., critical, major, minor) to facilitate determination of the appropriate processing and level of approval authority?
	6. Metrics
	a. Are statistical records for changes and deviations processing being maintained?
	b. Is the processing data being reduced to meaningful measurements that are used to maintain and improve the process?

4.2 Engineering Change Proposal

An Engineering Change Proposal (ECP) is the management tool used to propose a configuration change to a CI and its Government-baselined performance requirements and configuration documentation during acquisition (and during post-acquisition if the Government is the CDCA for the configuration documentation).

4.2.1 ECP Concepts and Principles

The following paragraphs define uniform concepts and principles by which the processing of ECPs is conducted. These standard ground rules are necessary to assure that there is a consistency and orderly process that can be expeditiously accomplished by all parties. The Government no longer imposes rigid DD-forms requirements, however MIL-STD-2549 identifies the data fields of information that constitute an ECP, and provides clear unambiguous definition of the data elements that should populate those fields when applicable to a given ECP.

The concepts in this section apply to class I ECPs, except where specifically identified as applicable to class II ECPs.

4.2.1.1 ECP Initiation. The initiation of an ECP begins at the government's request unless for one or more of the reasons cited in paragraph b. below. Since most ECPs occur in a sole source environment, the initiation of an ECP should be a well planned and coordinated effort between the government and contractor. A clear mutual understanding of the ECP objective, technical scope and the Government's performance, cost and schedule constraints shortens the lead time for ECP preparation. It also results in a complete and comprehensive proposal to facilitate timely and effective implementation. As with most processes, the three C's: Communication, Cooperation and Coordination are the keys to assuring successful change processing.

The "ECP Management Guide," **[Detail: Appendix G]** has been developed to assist both the Government and contractor during the request, preparation , approval and implementing phases of an ECP. It provides checklists to aid in the timely identification and coordination of essential technical information required for decision making in all three stages of the ECP process. It also fosters the integrated product and process team concept.

a. Solicited ECPS. Whenever the government identifies a need or requirement to change a CI and its configuration documentation a Class I ECP is formally requested from the contractor. A request for an ECP is coordinated with the applicable government Contracting Officer prior to being released to the contractor. **[Refer to: Check List (A) of Appendix G]**

b. Unsolicited ECPs. As a general rule, unsolicited Class I ECPs are discouraged. However, at the discretion of the procuring activity, a preliminary ECP may be submitted to allow evaluation of the desirability of expending resources to fully document a proposed change. Changes that impact the following areas are instances where unsolicited ECPs may be justified:

- Safety
- Compatibility.
- Correction of Defects.
- Survivability.
- Security.
- Product improvement(s) that may significantly reduce life cycle costs, including Value Engineering Change Proposals (VECP) consistent with the DFAR Value Engineering clause of the applicable contract
- Technology improvements

4.2.1.2 ECP Preparation and Submittal. Formal and preliminary ECPs are prepared and submitted to the Government in accordance with the configuration management requirements of the applicable contract SOW and associated Contract Data Requirements List (CDRL), DD Form 1423 citing the latest approved Data Item Description (DID) for submittal of ECP data. The contract CDRL should provide information on submittal and distribution of ECPs for Government review and processing .

The contractor (ECP Originator) should notify the Government immediately by electronic message (e.g. E-mail, Fax) when the need for an emergency or urgent priority ECP is determined. Follow-up to a message ECP should be in the form of a formal ECP submittal, within 30 days. However when this is impracticable, a preliminary ECP may be used as an interim measure. Both the preliminary ECP (if used) and the final ECP resulting from a message ECP would be identified as revisions of the initial message ECP. **[Detail: Activity Guide: Tables 4-3 and 4-4]**

a. Automated Processing of ECPs. If the Government has established a Government Configuration Management Automated Information System (CM AIS) system, or employs the DoD Standard Automated Change Control System (known as MEARS) as a stand-alone system, the contract data requirement for ECPs should request either the digital submittal of ECP data or population of the DoD data base directly by the contractor.

- The Government has specifically expressed its preference for a CM AIS in **MIL-STD-2549**.
- All ECP fields of information are defined in the MIL-STD-2549 data dictionary. **[Ref: MIL-STD-2549 Appendix C]** To provide communication between a contractor and the (planned) standard Government CM AIS, will require the ECP data to use these defined data elements.
- To use MEARS[3] as a standalone system, software must be provided to the contractor

b. ECP Content by Program Life Cycle Phase. Pertinent data fields of information (ECP data elements) that are to be provided by an ECP should be identified as described in MIL-STD-2549. Only the data fields that are populated need be provided with the ECP. Identifying the MIL-STD-2549 data fields will enable Government and the various commercial configuration management information systems to store and coherently display the ECP data. A significant advantage of using electronic commerce over paper forms is that each topic may be addressed in its entirety without having to meet paper form block limitations. MIL-STD-2549 data element definitions provide fields sizes that rarely limit ECP information.

Obviously those key data fields which identify and describe the change are mandatory in any ECP. Common sense and the current context and environment of the program for which the ECP is being submitted dictate which fields are to be populated. The typical content of an ECP may vary considerably during the CI's life cycle, and because DoD Directive 5000.1 gives Government Program Managers latitude in identifying the phases that they will employ, no two programs will necessarily be the same. The content guidance provided herein **[Detail: Activity Guide: Table 4-6]** reflects the general variability of ECP content that can be expected.

4.2.1.3 ECP Supporting Data. Supporting data should include, where necessary, supplementary information to support the change description and justify the need for change. Test data, analyses and other technical documentation providing supporting rationale for assertions made in the ECP, and upon which the configuration control authority can base its acceptance of the proposed change, can be included to the extent that the originator feels is necessary. In many cases, the proposed change or its justification will be easier to understand if "marked-up" copies or draft revisions of the TDP element (such as a "redlined" copy of a portion of a specification or an interface drawing, or a draft table providing new values to be included in a data base) are also provided as a part of the ECP package.

4.2.1.4 Review and Dispositioning ECPs. In order to facilitate dispositioning ECPs affecting documents for which the Government is CDCA, contracts should identify the government representative(s) responsible for dispositioning both Class I and Class II ECPs.. Where the Government is an Application Activity (AA), or in a performance based acquisition, where the Government is not CDCA for the design documentation, contracts should clearly specify Government and contractor responsibilities for Class I ECPs and RFDs affecting Government baselined performance specifications. This can be accomplished by incorporating a special configuration control clause in the contract similar to the example in the box on the next page. Guides for the dispositioning of Class I and Class II changes are provided in 4.2.2. **[Detail: Activity Guide: Table 4-7]** Key aspects of this process are highlighted, as follows:

[3] The OPR for MEARS is Commander, US Army MICOM, Attention: AMSMI-MMC-LS-SA (Mr. Mark Moe) Redstone Arsenal, Alabama, 35898-5238, DSN 746-9513

Example:

CONFIGURATION CONTROL PROCEDURES FOR ENGINEERING CHANGE PROPOSALS, AND DEVIATIONS - (STATEMENT OF WORK) (date)

(a) Any Engineering Change Proposal (ECP) or any Request for Deviation affecting an item being acquired under this contract shall be in accordance with attachment ( ), contract statement of work (SOW) paragraph(s) _____. Quantities and distribution, *or electronic delivery/access,* shall be as stated on DD form 1423 (Contract Data Requirements List) or distribution list attached hereto.

(b) No Class I engineering change shall be implemented until authorized by the Contracting Officer (CO).

(c) Each Class II engineering change shall be submitted to the cognizant Administrative Contracting Officer (ACO), or in the absence of such ACO, by (Insert applicable CFA, etc.) for concurrence in classification.

- or -

Each Class II engineering change shall be dispositioned by the Contractor.

(d) No major or critical deviation shall be effective until authorized in writing by the CO.

(e) Minor deviations, requested prior to manufacture, shall be authorized (or disapproved) by the ACO, or in the absence of such ACO, by (Insert applicable CFA, etc.).

- or -

Minor deviations, requested prior to manufacture, shall be dispositioned by the contractor

(f) Minor deviations to manufactured items shall be granted (or disapproved) by the local Material Review Board (MRB) when properly constituted, or in the absence of such ACO by _____.

(As used in paragraphs (b) and (d) of the foregoing clause, the term "Contracting Officer (CO)" means the "Procurement Contracting Officer (PCO)" or the "Administrative Contracting Officer (ACO)" if the contract provides that orders may be issued and priced by the ACO. The PCO or ACO may authorize only Class I engineering changes and major deviations which have been approved by the Procuring Activity Change Control Board (CCB). The PCO and ACO may authorize only critical deviations involving safety that have been approved by Procuring Activity Change Control Board (CCB) and by the Commander, _____Systems Command.

a. Dispositioning Class I ECPs. Class I ECPs must be dispositioned (approved or disapproved) for implementation by a properly constituted Government Configuration Control Board (CCB).**[See 4.1.1.3.a.]** After the CCB direction is issued, it is important to proceed expeditiously with the "definitization" process (obtaining a pricing proposal, auditing, fact finding, and negotiating the final price) for this change and issuing a supplemental agreement. Until the contract modification is received and bi-laterally agreed to by the Government and the contractor, the contractor is not authorized to proceed with the implementation of the proposed change.

The contractual approval or disapproval of an ECP should not be confused with the acceptance and approval of the ECP as a data deliverable. Approval of the ECP data delivery required by CDRL/DD Form 1423 signifies only that the ECP satisfies the requirements of the ECP DID and is considered acceptable for government processing. Acceptance of the data deliverable does not signify "technical approval" of the change proposed by the ECP and should not be interpreted as authorizing the performing activity(s) to proceed with the work proposed by the ECP.

All ECPs should be dispositioned by the Government as expeditiously as possible. The ECP indicates a date by which contractual authorization is required. This date should normally be proposed by the contractor to allow sufficient processing time by the Government. In some cases, expedited processing may be necessary in order to minimize the cost of the change or to enable it to be incorporated in time to satisfy an operational need. Since certain critical factors (such as safety or national defense preparedness) may be involved, it is important that the Government proceed with all due speed, but it is also important to ensure that proper priorities and need dates are being specified.

Because there is considerable urgency involved in effecting the changes proposed in urgent and emergency ECPs, the contractor normally specifies an authorization suspense date that is very close to the submittal date (e.g. 48 hours to make the technical decision on an emergency ECP and 30 calendar days to make the decision on an urgent ECP). **[Detail: Activity Guide: Table 4-5.]**

When the urgent or emergency priority is properly used, the contractor must be authorized to proceed with implementing the change as quickly as possible. Under these circumstances, it is often necessary to utilize a unilateral change order to the contract (or contracting officer letter) to provide official authorization to proceed. If the change order is to be used, a "not-to-exceed" price quotation (a "not-less-than" price for cost reduction ECPs) would be required to set a limitation on the price impact of the change activities to be accomplished. After the change order is issued, it is important to proceed as expeditiously as possible with the normal "definitization" process to minimize the risk of related price increase (or to maximize the related savings) resulting from the change.

VECPs are subject to essentially the same CCB process as other ECPs. Under the FAR clause, the Government is entitled to reimbursement of expenses incurred in processing an approved VECP before any cost savings are shared out to the contractor. Therefore, the tasking activity must develop auditable government cost information so that the complete monetary impact of the VECP can be evaluated. Any delays in VECP processing will typically reduce the savings benefit.

b. Dispositioning Class II ECPs. Unless otherwise specified by contract (e.g., as part of the Single Process Initiative), the government administrative contracting officer or plant representative serves as the dispositioning authority for Class II ECPs.. The default action required on Class II changes is concurrence/non-concurrence in classification only, unless the contract requires approval/disapproval. Government concurrence in Class II ECP classification normally allows the contractor to incorporate the change in the applicable CI and update its configuration documentation without any further government action or authorization being required. A non-concurrence in classification will normally result in the Class II ECP being canceled or reclassified to a Class I ECP.

The government should require approval/disapproval of class II ECPS only when the Government is the CDCA for the original drawings, or data files, and compliance with the specific detailed design is a requirement of the contract. If there is a government ACO or plant representative available, the Government tasking activity may elect to have the ACO or representative review the proposed class II changes for concurrence in classification before they are submitted to the government tasking/procuring activity (that is the CDCA) for approval **[Details: Activity Guide: Table 4-7]**

4.2.1.5 Implementing Class I ECPs. When ECPs are approved, change implementation to a CI being produced under contract is usually a straight forward contractual incorporation of the ECP as approved by the government CCB. CCB approval action is not to be considered authority for the contractor or tasking activity to proceed with the change.

- A CCB directive must be prepared, published and distributed. The CCB directive is identified by the CCB identifier and the change identifier. The date of the CCB directive and disposition are recorded.. Distribution should be limited to those parties required to take action to implement the change
- If implementation of the approved change is the responsibility of the contractor under the terms of a contract, the CCB approval action directs the procurement contracting officer to initiate instructions to the contractor
- If Contractor-initiated change proposals are involved, the receipt of a formal contract change for example, Standard Form 30, "Amendment of Solicitation/Modification of contract" or PCO letter (pending receipt of an amendment) shall constitute sole authority for the contractor to proceed.
- If the initiator is a government activity acting in the capacity of a contractor, the receipt of the directive/order (including funding authorizations) shall constitute sole authority to proceed with the change.

Change implementation to a CI in the inventory or operational forces will normally require the coordination of additional requirements of an implementing CCB directive (or tasking order).

- Necessary instructions and funding authorizations must be issued for the scheduled implementation of the change
- Change accomplishment reporting is directed. **[Details: Activity Guide: Table 4-8]**

The incorporation of approved changes should be planned so that optimum acquisition, production, tests, evaluation and operational advantages can be derived from the modified configuration. The change is effectively coordinated to ensure that the earliest possible availability and support of the CI is provided with minimum disruptive effect on planned operating cycles.

Changes shall be incorporated only after the Contract modification/PCO letter or implementing directive/order is published and logistic support is available, unless safety or critical mission requirements dictate otherwise. Unofficial or preliminary technical documents shall not be used as authority to incorporate changes.

The implementation of approved changes to a CI must always include the proposed incorporation of new and revised technical documentation. Provisions for change documentation should always be addressed by the change proposal, contract modification and/or CCB implementing directive/order. Change documentation may include such types of data as specifications, drawings, provisioning documentation, technical manuals, diagrams, sketches, parts lists, master configuration lists, computer program documentation, and test and evaluation procedures. Requirements for such change documentation may vary depending on the life-cycle phase, type and complexity of each CI and the change/modification. However, the documentation prepared for any change will normally include the following three categories:

- The documentation package (including the CCB implementing directive/order) forwarded to the change installing activities to install the change.
- The documentation required by the technical, training, maintenance, and supply management organizations to properly control and support the change.
- The documentation (e.g., technical manuals) required by the user activities to properly operate and maintain the CI after the change is installed.

4.2.2 ECP Activity Guides

The following ECP Activity Guides provide information concerning change classification, the justification for Class I ECPs, the types of ECPs, ECP priorities, ECP content, and the ECP dispositioning actions that may apply. ECPs are prepared and submitted to the government in accordance with the configuration requirements of the applicable contract SOW and CDRL/DD Form 1423. If the Government has established a CM AIS, the data requirement for ECPs should request digital submittal of ECP data or population of the DoD database directly by the contractor. **[Ref: MIL-STD-2549, Appendix A]** The communication between the contractor and Government CM AIS uses the pertinent data fields, arranged in the numbered sequence of the applicable **MIL-STD-2549, DIP4, subpacket (4A through 4F)** which cites the defined data elements of **MIL-STD-2549 Appendix C. [Detail: *Activity Guide*: Table 4-6]**

Table 4-2. *Activity Guide:* Change Classification

Class I Criteria: *MIL-STD-2549 establishes a Data Element Definition of a class I ECP in **DED 0164**, as follows*:

An ECP proposing a change to approved configuration documentation for which the Government is the CDCA or that has been included in the contract or statement of work by the tasking activity, **and**:

(1) affects any physical or functional requirement in approved functional or allocated configuration documentation, **or**

(2) affects any approved functional, allocated or product configuration documentation, **and** cost, warranties or contract milestones, **or**

(3) affects approved product configuration documentation **and** one or more of the following:

Table 4-2. *Activity Guide:* Change Classification

(a) Government furnished equipment,
(b) safety,
(c) compatibility, interoperability, or logistic support,
(d) delivered technical manuals for which changes are not funded,
(e) will require retrofit of delivered units,
(f) preset adjustments or schedules affecting operating limits or performance to the extent that a new identification number is required,
(g) interchangeability, substitutability, or replaceability of any item down to non-repairable subassemblies,
(h) sources on a source control drawing,
(i) skills, manning, training, biomedical factors or human engineering design.

Class II Criteria: *MIL-STD-2549 establishes the Data Element Definition of a class II ECP in **DED 0164**, as follows*:
An ECP proposing a change to approved configuration documentation for which the Government is the CDCA **or** that has been included in the contract or statement of work by the tasking activity, **and** which is not class I.

Guidance:

1. The first criteria for an ECP (both class I and class II) is that it is an engineering change; it must affect approved configuration documentation.
2. Furthermore an ECP is limited to a change to approved configuration documentation that is under Government configuration control; it must require a change to a document for which the Government (tasking activity) is the current document control authority (CDCA) or which is cited in a contract.
   a. The Government becomes the CDCA in several ways:
      - Provide the document as a Government document with Government CAGE code identification
      - Approve a contractor document and assume control by transferring CDCA and adding a Government CAGE code to the document. **[Detail: Appendix B]**
   b. The Government cites a configuration document in the contract in several ways:
      - Specifically addressing it, as in "Provide the system in accordance with Specification Performance
      - Defining in the SOW or CDRL, that the system performance specification, allocated performance specifications for specific CIs, and where applicable (e.g., in a design based acquisition) the product configuration documentation, shall be submitted for Government approval and configuration control.
      - Adding specific documents to the SOW by contract modification
3. Items (1), (2), and (3) amplify the criteria by providing specific evaluation factors to use in judging whether a proposed change to any document must be processed as a Class I or Class II ECP
   a. Item (1) - Since there are both contractor-approved and Government approved configuration documents, any change to contractor approved requirements must be examined to determine if it also impacts Government approved (CDCA or contractually cited) configuration documentation.
   b. Item (2) - This item concerns a change to Government controlled configuration documents, which if it did not impact cost, warranties, or milestones would not otherwise be class I. A change to contractor-controlled configuration documentation which might also affect cost, warranties or milestones, does not require a class I ECP because it is not a Government configuration control issue. — it is treated like a commercial item, i.e., the contractor is obligated to the contract provisions but can change the design of the product so long as it meets the specified performance requirements. If the contractor's design change makes the end product more or less costly, the contractor either absorbs the increase or benefits from the savings. The contractor must initiate contractual change action, outside the scope of configuration control, in order to change the contract cost, warranties or milestones.
   c. Item (3) provides some factors to evaluate when examining a proposed change to Government-controlled product configuration documentation. Many of these factors are specified by requirements in functional and allocated configuration documentation, covered by Item (1). A proposed change to PCD must be examined to see it impacts functional or allocated requirements.

Table 4-3. *Activity Guide:* ECP Justification Codes

Code	Title	Criteria for Assignment
B	Interface	Proposed to eliminate a deficiency consisting of an incompatibility between CIs.
C	Compatibility	1. To correct a deficiency discovered during system or item functional checks or during installation and checkout and the proposed change is necessary to make the system/item work 2. Except for Government caused changes (e.g., a deficiency in GFE or GFI), the contractor agrees that effort to accomplish the change is within the scope of the existing contract; and the contract price will not be increased as a result of the formal documentation of the engineering change and corrective action in production, and to delivered in-warranty items (or as stipulated in the contract). 3. Accepting the conditions of 1. and 2. enables the contractor to expeditiously correct the specific system/item in the location where the deficiency was discovered. 4. The contractor must also notify the Government within 48 hours after determining that a compatibility change is necessary. The contractors message must define the need, identify factors that are impacted, and provide a preliminary estimate of cost and schedule. A formal ECP is required 30 days after the initial message. 5. Where further procurement or manufacturing action is necessary due to lead time considerations prior to approval of a Code C ECP, the contractor may proceed at his own risk (except where the Government caused the deficiency), after notifying the Government of the additional systems/items to be corrected.
D	Correction of Deficiency	To eliminate a deficiency. Code D is used if a more descriptive code (such as S, B, or C) does not apply.
O	Operational or Logistic Support	To make a significant effectiveness or performance change in operational capability or logistic support. Commonly known as an improvement change.
P	Production Stoppage	To prevent slippage in an approved production schedule, where delivery to current configuration documentation is impractical or cannot be accomplished without delay.
R	Cost Reduction	To provide net total life cycle cost savings to the Government and not pursuant to a contract VE clause. Code R ECPs include cost and price of the current contract(s), plus costs resulting from associated changes in delivered items (retrofit), and life cycle logistic support.
S	Safety	Correction of a deficiency that is a hazardous condition
V	Value Engineering	To effect a net life cycle cost reduction, and the VECP is being submitted pursuant to the Value Engineering (VE) clause of the contract: 1. VECPs are prepared and submitted in accordance with the Federal Acquisition Regulation (FAR) "Part 48 Value Engineering" and the Defense Federal Acquisition Regulation Supplement (DFAR) "Part 248 Value Engineering" when specified in the contract. 2. Under the incentive clause normally contracts over $100K include either the voluntary (incentive) clause or the mandatory (program clause). 3. The effort required to develop the design change proposed by the VECP, and the effort to generate the VECP package, is accomplished entirely at the contractor's risk; only if the government approves the VECP does the contractor get reimbursed for the effort. 4. With cost reduction (R code) ECPs or VECPs under the mandatory program, the contractor is funded by the government for the development of the design and the ECP, normally based on a preliminary change document and is reimbursed for the effort whether the ECP is approved or disapproved. Note: Both cost reduction ECPs and VECPs result in cost savings to the government on current contracts; they may also result in life-cycle cost savings. For both the cost reduction ECP and VECP, the contractor will share in the cost savings on current contracts based on predetermined share ratio; however, since the contractor assumed the risk in undertaking the change development, the contractor's share of the saving is much larger when VECPs are involved. Also with the VECP, the contractor may be entitled to a share of the cost savings for future contracts and for related programs according to conditions set forth in the FAR clauses.

Table 4-4. *Activity Guide:* Class I ECP Types and Their Function

All types of Class I ECPS may be submitted to the Government electronically, the type categorization relates not to format but to give a quick indication of the intent of the ECP

Type of ECP	Function
Message	Although not formally considered a type of ECP, Engineering changes with an emergency priority are often submitted in a message that provides less detail than a preliminary ECP; urgent priority ECPs sometimes are also initially documented in messages, as are notifications of compatibility changes **[See table 4-3].** They should be followed up by a complete ECP package within 30 days (or a PECP, see below, if that is not practical) because they normally do not include sufficient detail for the government to determine the full impact on program requirements.
Preliminary, (Type P)	Preliminary ECPs are used to address the impact of proposed changes in general terms sufficient enough for the government to determine if final ECPs are warranted. They are the used by program managers when: • The complexity of a proposed change may require extensive funding, development or engineering. • A choice of alternative proposals is appropriate; especially if a solicitation or contracting requirement is being competed between two or more contractors. • Authority is required to expend resources to fully develop a change proposal. • The government wishes to restrict configuration change activity. • Approval is required to proceed with software engineering development. • As follow-up to a message ECP when it is impractical to submit a complete Formal ECP within 30 days. This preliminary ECP would provide additional detail information supplementing the message ECP to provide the Government with a more considered analysis of the impacts and scope of the proposed change. In many cases such as Emergency, Urgent, Compatibility, the Government may have already authorized the contractor to proceed with the work based on the initial message.
Formal (Type F)	A formal ECP is the type which provides engineering information and other data sufficient to support formal CCB approval and contractual implementation by the Government

Table 4-5. *Activity Guide:* ECP Priorities

One of the following priorities shall be assigned to each Class I ECP by the originator to indicate the urgency with which the ECP is to be reviewed, evaluated, ordered, and implemented. (The proposed priority as assigned and will stand unless the tasking activity has a valid reason for changing the priority.)

Priority Code	Criteria
Emergency	An emergency priority is assigned to an ECP for any of the following reasons: (1) To effect a change in operational characteristics which, if not accomplished without delay, may seriously compromise national security; (2) To correct a hazardous condition which may result in fatal or serious injury to personnel or in extensive damage or destruction of equipment. (A hazardous condition usually will require withdrawing the item from service temporarily, or suspension of the item operation, or discontinuance of further testing or development pending resolution of the condition); or (3) To correct a system halt (abnormal termination) in the production environment such that CSCI mission accomplishment is prohibited.
Urgent	An urgent priority is assigned to an ECP for any of the following reasons: (1) To effect a change which, if not accomplished expeditiously, may seriously compromise the mission effectiveness of deployed equipment, software, or forces (2) To correct a potentially hazardous condition, the un-corrected existence of which could result in injury to personnel or damage to equipment. (A potentially hazardous condition compromises safety and embodies risk, but within reasonable limits, permits continued use of the affected item provided the operator has been informed of the hazard and appropriate precautions have been defined and distributed to the user.) (3) To meet significant contractual requirements (for example, when lead time will necessitate slipping approved production or deployment schedules if the change was not incorporated) (4) To effect an interface change which, if delayed, would cause a schedule slippage or increase cost (5) To effect a significant net life cycle cost savings to the tasking activity, as defined in the contract, where expedited processing of the change will be a major factor in realizing lower costs (6) To correct a condition causing unusable output information that is critical to mission accomplishment (7) To correct critical CI files that are being degraded (8) To effect a change in operational characteristics to implement a new or changed regulatory requirement with stringent completion date requirements issued by an authority higher than that of the functional proponent.
Routine	A routine priority is assigned to an ECP when emergency or urgent implementation is not applicable, required or justifiable..

Table 4-6. *Activity Guide:* ECP Content

MIL-STD-2549, Data Information Packet 4 (DIP 4)		MIL-STD-973 App. D	Class II Sub-packet		Class I Sub-packet			
Seq. No.	**Field**	**Block No.**	**4A**	**4B**	**4C** Msg	**4D** Prelim	**4E** Final-Log.	**4F** Final-No Log.
DIP 4 Subpacket identification								
Class II ECP: 4A - ECP contains "from-to" information; 4B - ECP does not include "from-to" information		**Class I ECP:** 4C - Message ECP; 4D - Preliminary ECP; 4E - Final ECP addressing logistics impact; 4F - Final ECP which does not address logistics impact						
✓	*Check marks below are either mandator or optional - Refer to Table DIP4-I of MIL-STD-2549*							
ECP Identification And Administrative Attributes								
2, 4- 6	ECP Identification & Rev, ECP Title	8b., D., F., 13	✓	✓	✓	✓	✓	✓
7-24	**Security, Rights, Distrib, Data Rights (Basic Document Protection Data Information Packet 8A)**	Marking Reqt.	✓	✓	✓	✓	✓	✓
Constant	ECP Type	8e.	These elements are automatic based on which sub-packet is being transmitted					
Constant	ECP Classification	5.						
28	ECP Priority	7.			✓	✓	✓	✓
29	ECP Justification Code	6.			✓	✓	✓	✓
30-31	CDCA and Effective Date	N/A	✓	✓	✓	✓	✓	✓
32-33	Current ECP Status & Date	CSA. Data	✓	✓	✓	✓	✓	✓
34	Originator (Company Name)(See Seq. 186)		✓	✓	✓	✓	✓	✓
35-37	Application Activities[4] & Status Of Adoption Or Rejection Of ECP Change	N/A	✓			✓	✓	
38	In Production	17	✓	✓		✓	✓	✓
39-40	Procuring Activity No. (PAN)[5] & PAN Yr.	2.	✓	✓		✓	✓	✓
ECP General Impact Information								
41	Baseline Affected	9	✓	✓	✓	✓	✓	✓
42-44	Primary And Related ECPs, If Any	28, 29	✓	✓		✓	✓	✓
46-48	Recurring RFD Resolved by ECP	N/A	✓	✓		✓	✓	
49	Order of Implementation (Before, With, After Other Retrofit ECPs)	46, 49	✓	✓		✓	✓	✓
Description of Change								
50-51	Description Of Change (Summary) + Link To Detail	19	✓	✓	✓	✓	✓	✓
52-53	Need For Change (Summary) + Link To Detail	20	✓	✓	✓	✓	✓	✓
57	Retrofit Required?	23, 43-48			✓	✓	✓	✓
58	Recommendation For Retrofit Kit Delivery	23c				✓	✓	✓
59-62	Ship/Vehicle Class, Location, Qty	22				✓	✓	✓
63-67	Identification of Supplemental or Affected Docs (Flag, Type, Source, Ident. Rev.	11, 12	✓	✓	✓	✓	✓	✓
68	Specific affect		✓	✓		✓	✓	✓
69-70, 72-73	Affected Part/Material/Software Ident	16, 18	✓	✓	✓	✓	✓	✓

[4] Indicates there are several Government Activities baselining or using CI
[5] Used by Procuring Activity

Table 4-6. *Activity Guide:* ECP Content

MIL-STD-2549, Data Information Packet 4 (DIP 4)		MIL-STD-973 App. D	Class II Sub-packet		Class I Sub-packet			
Seq. No.	**Field**	**Block No.**	**4A**	**4B**	**4C** Msg	**4D** Prelim	**4E** Final-Log.	**4F** Final-No Log.
74-78	Effectivity	21, 23a	✓	✓	✓	✓	✓	✓
79	Forward/Retrofit				✓	✓	✓	✓
85-86	Contractor Field Service & Link	N/A				✓	✓	✓
87-93	Information about Retrofit including Work Hours To Install Retrofit Kits And Test	44-45, 47- 48				✓	✓	✓
Contract Information								
94-95	Contract /Mod	14.	✓	✓	✓	✓	✓	✓
96	Contract line Item				✓	✓	✓	✓
97	Proposed Delivery Schedule	22, 23c				✓	✓	✓
Links to Impact Description								
98	Developmental Program Requirements	34				✓	✓	
99	Trade-Offs & Alternate Solutions	35, 41				✓	✓	
100-111	Effect 0n Logistic Support Elements	38.a.- n.				✓	✓	
112-121	Effect on Operational Employment	39.a.- j.				✓	✓	✓
122	Effect On Operational, Maintenance Or Training Software	38.f., 40.d.				✓	✓	✓
123-124	Date contractual Authority Needed for Production, Retrofit	50.a., 50.b				✓	✓	✓
125	Consequences of Disapproval	20	✓	✓		✓	✓	✓
126--128	Effect On Product Configuration Documentation/Contract	37.a - c.				✓	✓	✓
129-138	Other Considerations	37.e, 40.b., d.-i.				✓	✓	✓
139	VECP Royalty Expiration Date	N/A					✓	✓
Estimated Net Total Cost Impact								
140-144	Total Costs/Savings	51.e, h					✓	✓
145	DoD Service component Bearing Cost	N/A					✓	✓
146-184	**Cost Spreadsheet File Identification (Data Information Packet 9B)**	51, 52					✓	✓
ECP Files								
185-223	**Expanded Text File Data Identification (Information Packet 9B)** (includes Seq. 186-Originator Address, and detail for all link fields)	Referenced Enclosures and paragraphs				✓	✓	✓
224-261	**File Identification ECP Implementation Schedules (Hardware/ Software)**	53-60				✓	✓	✓
262-299	**Document Representation Data Identification (Information Packet 10A)**	N/A	✓	✓	✓	✓	✓	✓
300	Associated NOR(S), If Applicable	11, 12	✓	✓		✓	✓	✓

Table 4-7. *Activity Guide:* ECP Review and Disposition Actions

ECP Type & Action	Disposition By	Governing Criteria
Class I ECP Approval	Government CCB	1. CCB decision does not mean that the contractor is authorized to proceed with the performance of the change activity. 2. Additional government actions, e.g., preparation of required funding documents and authorizations are usually necessary before the contractor or Government can be told to officially proceed with the change. • A formal contract modification is processed by the program manager through the Contracting Officer (CO) to effect a Contractor ECP. • An approval letter from the program manager (or other representative identified in the applicable tasking directive) is required to effect a performing Government activity ECP.
CLASS I ECP Disapproval/ Rejection	Government. Program office or CCB	1. When Class I ECPs are disapproved, the only government action normally required is preparation of a disapproval letter to be transmitted by the CO or other representative identified in the contract. 2. DoD policy requires that, as a courtesy, the ECP disapproval letters should provide the rationale for disapproval. 3. The notification of rejection may include direction to revise and resubmit the ECP.
Class II ECP[6] Concurrence or Non-concurrence	Government Plant Representative Office or other Designated Government Activity (On rare occasions, the issue of concurrence in classification is deferred to the Procuring Activity for disposition)	1. Government concurrence in Class II ECP classification, when required by contract, signifies that the proposed change does not impact any of the Class I ECP criteria **[Table 4-3]**. 2. Government concurrence normally allows the contractor to incorporate the change in the applicable CI and update its configuration documentation without any further Government CCB action, authorization, or contract modifications being required. 3. A non-concurrence in classification may result in the Class II ECP being: • Revised, reclassified and re-submitted as a Class I ECP for approval • Withdrawn if the proposed change is not desired. (Non-concurrence has the same effect as disapproval because it does not allow the contractor to incorporate the change)
Class II ECP Approval or Disapproval	Designated Government Activity	1. Required only when unique program requirements deem it necessary, e.g. Government approval of Class II ECPs may be required when approval/disapproval authority is assigned to a Government activity different than the Government Plant Representative Office or the procuring activity. 2. Government Plant Representative Office concurrence in classification may be required prior to submittal.

[6] Under a performance based procurement, Class IIs need not be submitted for concurrence/approval if documentation affected is under contractor's control

Table 4-8. *Activity Guide:* ECP Implementation Actions

Government Activity	Implementing Action
CCB preparing Activity	Prepares the change implementing directive/order designating specific responsibilities to associated activities in support of the change. These specific responsibilities may include: • Obtaining, issuing and distributing retrofit kits, including redistribution. • Obtaining, issuing and distributing engineering and installation data packages. • Logistics, test and evaluation activity requirements.
Logistics Manager	1. Distributes the preliminary directive/order for review, validation, check out and comment, revises the implementing directive/order in accordance with accepted comments, and provides the final change implementing directive/order to the ICP. 2. If the change affects hardware or firmware, prepare, or have provisioning documentation prepared and forward to the applicable Inventory Control Point (ICP). 3. Ensure that all training requirements are addressed. 4. Manage ECP Implementation when retrofit is involved
ICP	1. Distributes the directive/order and associated documentation to the installing activities, supply storage points, repositories, training activities and OPR, as appropriate. 2. Provision the change (i.e., make sure the necessary spares are ordered)
Technical Data Manager	Review the proposed data revision requirements, recommend or prepare necessary revisions, and forward them as directed by the preparing activity.
Technical Manual Manager	Prepare, or have appropriate technical manual revisions prepared
Manufacturing and Development Activity	1. Prepare/revise the specifications, drawings, lists, material, process and computer program specifications; computer programs, testing procedures, quality assurance procedures, classification of defects requirements, etc., needed for hardware or firmware manufacture or computer software change 2. Manufacture the changed hardware and firmware, assemble the technical documentation (retrofit instructions), hardware, firmware, and computer program change into a retrofit kit to meet the delivery schedule established by the CCBD 3. Manufacture or have the spare/support parts manufactured or modified, unless they are to be accomplished by the ICP
ICP	Conduct initial check out/validation of the retrofit kit/retrofit instructions
ICP	Provide each change installing activity with a work package planning document for each approved change or block of changes include, but is not limited to: • Change implementing directive/order identification number(s). • Item identification. • Serial numbers affected. • Man hours and skill areas required to accomplish the change(s). • Any prerequisite or conjunctive changes required. • Any special instructions (for example, additional material, tools, equipment). • Funding authority. • Schedule for installation. • Training schedules and sources required to effect the change, and operate and maintain the reconfigured item.
Change Installing Activity	1. Based on the work package planning document, adjust work schedule to accommodate scheduled implementation, accomplish prerequisite changes, accumulate the materials, tools, equipment, etc., to implement and support the change, and implement the change as directed/ordered.

Table 4-8. *Activity Guide:* ECP Implementation Actions

Government Activity	Implementing Action
	2. Install change in accordance with the priority assigned and the dependency criteria documented in the implementing directive/order. 3. The change shall be installed in training and test items at the earliest opportunity. 4. Changes in priority of accomplishment, addition or deletion of changes, and change substitutions shall be avoided after the actual change work has been started. However, when installation schedules cannot be met, the installing activity shall advise the appropriate OPR and CCB so that the schedules can be revised or consideration may be given to possible cancellation of the change. 5. The installing activity shall report change implementation in accordance with the requirements of the implementing directive/order.
Reporting Activity	1. All change accomplishment reports shall be initiated by the installing activity and, if different, provided to the custodian of the changed item for processing to the data repository and OPR. 2. Change accomplishment reporting shall be consistent with the applicable configuration status accounting (CSA) system. Reporting the accomplishment and effectiveness of changes in the format prescribed. Accomplishment reporting shall be done promptly so that CSA and ILS can be updated. Effectiveness reporting, when required, shall be done promptly so that continued change implementation can be reevaluated.
Data Repository	Provide for the maintenance of CSA records during the Operating and Support phase of the CI's life-cycle. **[Detail: Section 5]**

4.3 Request for Deviation

A deviation is a specific written authorization to depart from a particular requirement(s) of an item's current approved configuration documentation for a specific number of units or a specified period of time. It differs from an engineering change since a deviation does not effect a change to a configuration document.

Deviations are requested by contractors prior to manufacture, during manufacture, or after an item has been submitted for Government inspection and acceptance.[7] To be tendered for delivery or to be installed in an item to be tendered for delivery, the deviant item must be suitable for use.

4.3.1 RFD Concepts and Principles

Requests for Deviation (RFDs) are most often used for production CIs delivered as a part of a production contract They are typically associated with current, or future, delivery of items that do not, or will not, conform to the Government-baselined configuration documentation. An RFD is submitted, if during design and development, the contractor determines that for a valid reason (such as long lead time) a Government required performance attribute will not be met or verified before scheduled delivery of a limited number of production units. An RFD is also submitted when prior to the beginning of the final assembly of the first affected serial-numbered unit of a CI, the contractor finds it necessary to deliver one or more parts in a configuration other than that described by the item's baselined documentation. RFDs must pertain only to the technical requirements of a CI and not the bulk materials used in manufacture.

a. RFD Classification. RFDs are classified by their originators as either Minor, Major or Critical, unless the contract specifies that a government's technical representative is responsible for assigning the classification. The classification designations match the corresponding classification of characteristics specified in MIL-STD-2101.

b. RFD effectivity. RFD effectivity is the means used by the originator to specifically designate each separate unit (or lot of units) of the CIs that are known to be, or that will be, impacted by a proposed RFD. All units impacted by an RFD must be identified by serial number, lot number, or similar identifier that allows identification of affected units.

c. RFD preparation and submittal. RFDs are prepared and submitted to the government in accordance with the configuration management requirements of the applicable contract including the CDRL/DD Form 1423 citing the latest approved DID for RFDs. RFDs must be approved or disapproved based on the merits of the initial submittal. However, changes to a previously submitted RFD not yet approved, may be addressed as a revision to the initial RFD number.

If the Government has established a Government CM AIS system for the program, the data requirement for RFDs should request either digital submittal of RFD data or population of the DoD data base directly by the contractor. All RFD fields of information are defined in the MIL-STD-2549 data dictionary. **[Ref: MIL-STD-2549 Appendix C]** To provide communication between a contractor and the (planned) standard Government CM AIS, will require the RFD data to use these defined data elements. The pertinent data fields should be arranged in the numbered sequence provided in MIL-STD-2549 to enable Government and many commercial configuration management tools to store and display the RFD data coherently. **[Detail: Activity Guide: Table 4-9]**

d. RFD approval/disapproval decisions. A Critical RFD should not approved by the Government except under the most extenuating circumstances; and with the approval of the Activity's Commanding Officer. Critical RFDs involve a departure from requirements that have a profound impact on safety. They affect

[7] A deviation requested during or after manufacture was formerly called a waiver. However, the processing rules for a request for waiver are identical to those for a deviation, and the terms deviation and waiver where often confused. The DoD will no longer maintain the redundant processing, forms or data fields, and instructions.

operational capabilities (including service life) of a CI, and its logistics supportability. It is therefore considered unacceptable to authorize the manufacture of a CI incorporating a Critical RFD.

Major RFDs (and critical RFD's subject to limitations expressed above) must be approved or disapproved after careful review and consideration by a government CCB. Once approved, additional government actions or authorizations may still be required. An approved RFD will normally require a formal contract modification or an approval letter signed by the government CO.

RFDs are normally processed for benefit of the contractor, since the government wants the contractually-specified configuration. The FAR (46.407) specifies that the government normally should accept "non-conforming material" only when it is in the Government's best interests, and there is appropriate consideration. Therefore, if the RFD is approved, it is imperative that the government contracting officer negotiate an equitable consideration from the contractor based on either (or both) the quantity of CIs affected by the RFD or the extent the affected CIs do not meet the government's contractual requirements. Based on the CCB review, the appropriate consideration to the government resulting from RFD approval should be estimated and furnished to the contracting office for negotiation.

When major and critical RFDs are disapproved, all that is normally required is a disapproval letter signed by the CO or other government representative identified in the contract. An RFD disapproval letter should state the reason(s) for disapproval.

Minor RFDs are normally approved by the government CAO or other representative identified in the contract. In the case of minor RFD occurring during manufacture, minor RFDs are normally approved or disapproved by a properly constituted Material Review Board (MRB) **[MIL-STD-1520]**. In the absence of a MRB, approval or disapproval will be made by either the government ACO or technical representative identified in the contract. In most instances, the approval or disapproval of minor RFDs, due to their simplistic nature, is not considered significant enough to require subsequent government action or authorization.

In a performance based acquisition, where the Government has not established a product baseline, minor deviations to Government approved configuration documentation should be extremely rare; most if not all should impact only contractor controlled configuration documentation and should be dispositioned using the contractors material review process.

CIs tendered for delivery with either approved Government or contractor RFDs must be suitable for their intended use without requiring subsequent repair or restoration at government expense.

e. Recurring RFDs. A recurring RFD is a repetition or extension of a previously approved RFD which applies to the same CI and contractor. Where a contractor experiences the same situation for the first time on more than one CI, each experience must be treated as a first time occurrence. Likewise, if multiple contractors experience the same situation for the first time, it must also be treated as a first time occurrence under each applicable contract.

Action should be taken by the government to ensure that approved RFDs are rarely submitted on a recurring basis. Recurring RFDs should trigger government concern that either corrective manufacturing action needs to be implemented by the contractor or that the CI's technical requirements may be too stringent. In the case of the latter, the government should request a Class I ECP from the contractor for revising the CI's current technical documentation.

4.3.2 RFD Activity Guide.

RFDs are prepared and submitted to the government in accordance with the configuration requirements of the applicable contract SOW and CDRL/DD Form 1423. If the Government has established a CM AIS, the data requirement for RFDs should request digital submittal of NOR data or population of the DoD database directly by the contractor. **[Ref: MIL-STD-2549, Appendix A]** The communication between the contractor and Government

CM AIS uses the pertinent data fields, arranged in the numbered sequence of MIL-STD-2549, DIP4, subpacket 4G, which cites the defined data elements of **MIL-STD-2549 Appendix C.**

The following Activity Guide **[Table 4-9]**, delineates the data content of an RFD.

Table 4-9. *Activity Guide:* RFD Content

MIL-STD-2549, Information Packet 4G		MIL-STD-973 Appendix E
Seq. No.	**Field Name**	**(DD1694) Block No.**
RFD Identification And Administrative Attributes		
2, 4-6	RFD Identification & Rev, RFD Title	7b., d.,
7-24	**Security, Rights, Distrib, Data Rights (Basic Document Protection Data Information Packet 8A)**	Separate Reqt.
27	RFD Classification	14.c.
30-31	CDCA and Effective Date	N/A
32-33	Current RFD Status & Date	CSA data
34	Originator (Company Name) Note: Address is in Seq. 186	8
35-37	Application Activity & Status of Adoption/Rejection	N/A
39-40	Procuring Activity No. (PAN)[8] & PAN Yr.	2
RFD General Impact Information		
41	Baseline Affected	8
42-44	Recurring/Prior Deviation Identification	18
Description of Deviation		
50-51	Description Of Deviation (Summary) + Link To Detail	22
52-53	Need For Deviation (Summary) + Link To Detail	23
54	Link to Rationale for Recurring Deviation	N/A
55-56	Summary & Link to Corrective Action	24
63-68	Identification Of Supplement/Support Documents (Flag, Type, Source, Identifier, Rev and Specific affect	22
69-73	Affected Part/Material/Software identification	13, 15-16
74-78	Effectivity of RFD	17
Contract Information & RFD Impact		
94-96	Contract/Mod/Line Item	11
97	Effect on delivery schedule	20
140	Effect on cost/price	19
144	RFD Price Consideration rationale	19
185-223	**Expanded Text File Identification (Data Information Packet 9B)** (includes Seq. 178 -Originator Address, and detail for all link fields)	Referenced Enclosures and paragraphs
262-299	**Document Representation Identification (Data Information Packet 10A)**	

[8] Used by Procuring Activity

4.4 Notice of Revision

A Notice of Revision (NOR) is an ancillary document to the ECP, which conveys the specific change to a specific document. A NOR is required when (1) the ECP is proposed by the Government (in the role of tasking or performing activity), (2) the party proposing the ECP is not the CDCA of the document being changed by the ECP, (3) the ECP is proposed by the tasking activity, or (4) the party proposing the ECP is not responsible for pricing logistics support impact.. For ECPs to documents that are controlled by the ECP originator, a NOR may be used at contractor option. Alternatively, the originator may describe the change to each document within the ECP.

Note: *Requirements for SCNs have been eliminated because of their administrative complexity and because in the digital environment, it is preferable to maintain the specification current at all times and to archive each proceeding version. Furthermore, paragraph rather than page control of specifications is feasible and desired. Revised paragraphs can be inserted into the ECP, and be approved as part of the ECP, or where that is not practical, submitted to the approving authority during ECP implementation.*

4.4.1 NOR Concepts and Principles

ECP originators who do not control the configuration documentation (for example, specifications, master engineering drawings, associated data lists, computer software listings, and other similar documents) must prepare and attach a NOR with each proposed ECP that impacts such documentation. This is imperative since they do not have the capability of revising the documentation for documenting the redesign. Once an ECP is approved, the attached NOR allows the program office to direct the government activity responsible for maintaining the documentation to accurately update it.

NORs are prepared and submitted to the government in accordance with the configuration requirements of the applicable contract SOW and CDRL/DD Form 1423. If the Government has established a CM AIS, the data requirement for NORs should request digital submittal of NOR data or population of the DoD database directly by the contractor. **[Ref: MIL-STD-2549, Appendix A]** The communication between the contractor and Government CM AIS uses the pertinent data fields, arranged in the numbered sequence of MIL-STD-2549, DIP4, subpacket 4J which cites the defined data elements of **MIL-STD-2549 Appendix C. [Detail: *Activity Guide*: Table 4-10]**

4.4.2 NOR Activity Guide

Table 4-10. *Activity Guide:* NOR Content

MIL-STD-2549, Information Packet 4J		MIL-STD-973 Appendix G
Seq. No.	**Field Name**	**(DD1694)Block No.**
	NOR Identification And Administrative Attributes	
2, 4-6	NOR Identification & Revision	5, 6
7-24	**Security, Rights, Distrib, Data Rights (Basic Document Protection Data Information Packet 8A)**	Separate Requirement
30-31	CDCA and Effective Date	N/A
32-33	Current NOR Status & Date	1, 14, 15a.- c
34	Originator (Company Name)	4.A.-B.
64-67	Identification of Affected Document (Type, Source, Identifier, Revision)	7, 8, 9, 10
68	Specific Affect on Document (i.e., Description of Revision)	13
262-299	**Document Representation Identification (Data Information Packet 10A)**	
301-325	**Parts List Changes (Data Information Packet 7B)**	13
326-330	Changes to Notes	13

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SECTION 5
CONFIGURATION STATUS ACCOUNTING

	QUESTIONS THIS SECTION WILL ANSWER	Para.
1.	What is Configuration Status Accounting? What is its purpose?	5.1
2.	Does the Government need to do configuration status accounting? What are the basic differences between Government and contractor CSA?	5.2
3.	How does the process vary over the life cycle? What are the CSA tasks to be accomplished? What are the outputs from CSA and how are they used?	5.1, 5.2
4.	What processes have to be in place in order for a complete status accounting process to be possible?	5.2, 5.3
5.	How can a status accounting process be evaluated?	5.3
6.	What information should be captured over the life cycle of the program? What information does the contractor capture? What are the inputs that the Government needs over the life cycle?	5.2, 5.3
7.	What is the purpose of the MIL-STD-2549 data model? How do we use it to achieve a consistent array of information between the Government and prime/subcontractors and vendors?	5.2, 5.3
8.	How should CSA be tailored to meet the needs of a specific program?	5.3, Appendix B

5.1 Configuration Status Accounting Activity.

Configuration status accounting (CSA) is the process of creating and organizing the knowledge base necessary for the performance of configuration management. In addition to facilitating CM, the purpose of CSA is to provide a highly reliable source of configuration information to support all program/project activities including program management, systems engineering, manufacturing, software development and maintenance, logistic support, modification, and maintenance.

Figure 5-1 is the activity model for CSA. The inputs, outputs, facilitators and constraints in this model are simply extracted from the overall CM activity model in section 2 **(Refer back to Figure 2-1).** CSA receives information from the other CM and related activities as the functions are performed. It is constrained only by contractual provisions which establish the program life cycle phase, tasks to be performed and the organization (Government or contractor) tasked to perform them. In addition to the use of automated configuration management tools based on the MIL-STD-2549 conceptual schema, the process is aided or facilitated by the documented CM process and open communications. The outputs from this activity provide visibility into CM document, activity status and configuration information concerning the product and its documentation. They also include "metrics" developed from the information collected in the CSA system and management "prompts" resulting from analysis of the CM data base.

5.2 CSA Concepts and Principles.

Because the complexion of the objects about which status accounting information is collected changes during the item life cycle, as shown in **Figure 5-2**, the specific outputs will vary. The inputs and outputs in Figure 5-1 may be thought of as generic categories for which there are different specifics in each phase.

The high level summary of CSA tasks shown in the center of Figure 5-1 reflect the functional performance capabilities of a complete CSA process which includes both Government and contractor activity.

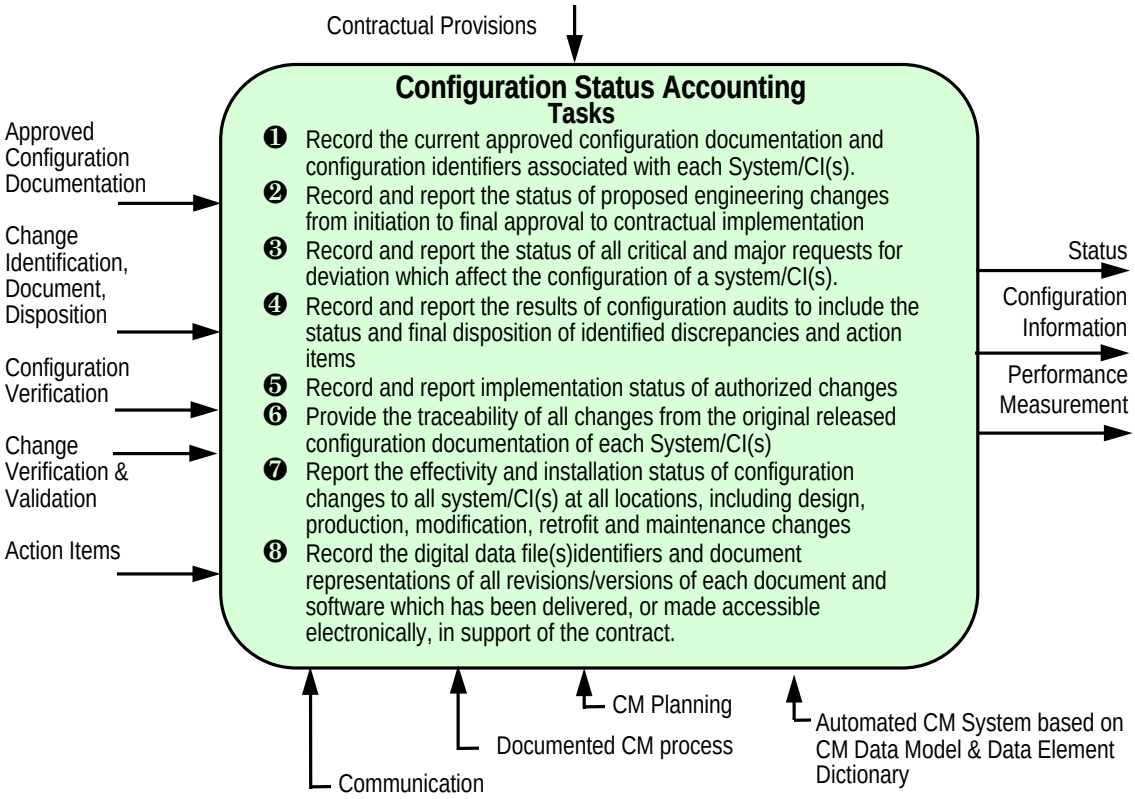
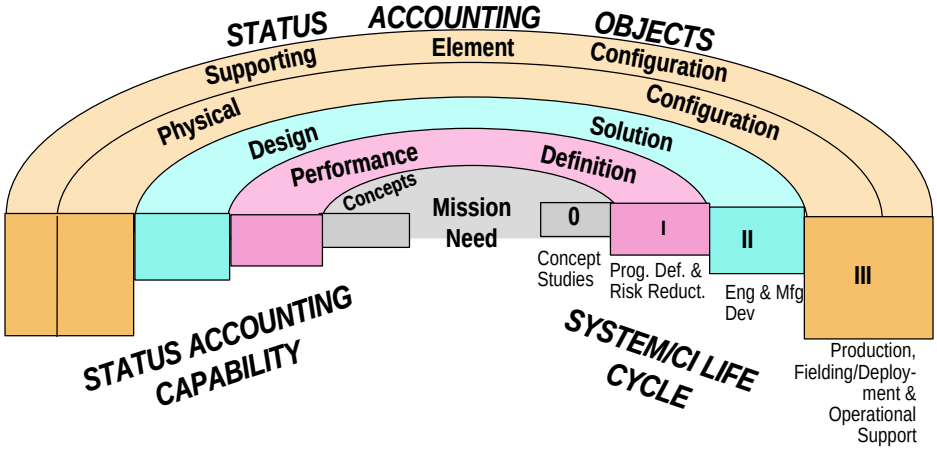


Figure 5-1. Configuration Status Accounting Activity Model



CSA evolves over the product life cycle, capturing more detailed information and enhancing its value as an information resource

Figure 5-2. Configuration Status Accounting Evolution over the System/CI Life Cycle

Some of these tasks also may not span the entire life cycle. The allocation of responsibilities within these functions (tailoring) must be accomplished during the CM planning activity and should take into account the degree to which the Government information technology infrastructure has been upgraded.

Contractor Integrated Technical Information services (CITIS) is the CALS (Continuous Acquisition Life Cycle Support) term used to describe the interfacing technology enabling the Government to access data from contractor systems and to transfer data electronically **[Details: Section 7]**. Under such an environment, information will reside where it is most economical and will be accessible for use, on line, by all who have appropriate data rights and are granted access privileges. Contractor and Government CSA information could be merged in what would appear to be a seamless (virtual) data base. The goal of a fully integrated data environment in which Government and contractors share information is technically within reach. In such an environment, data input by one source is accessible to all associated organizations in the program chain from subcontractors to contractors, government acquisition offices, depots, and maintenance and other field activities.

The Government's Automated Configuration Management Information System (CM AIS) and **MIL-STD-2549** are essential steps in the process of achieving that goal . Fully automated, interactive contractor/Government CSA systems which implement the conceptual schema defined by the **MIL-STD-2549** data model/data element dictionary would be capable of moving data from one system to the other and of on-line access. Such systems linked to Government and contractor data repositories for retrieval of archival data, would be the cheapest possible operational scenario with the most accurate and easily accessible information. Querying a DoD CSA data base would yield such information as

- The as-designed, as-built, as-delivered, or as-modified configuration of any serial number of the product as well as any component within the product.
- For software, the as-delivered, as modified, as tested configuration of any CSCI, as of any date.
- The current status of any change, the history of any change, and the schedules for and status of verifications and audits, as well as resultant action items
- Metrics (performance measurements) on CM activities for use in monitoring the process and in developing continuous improvements. To the extent that contractor and Government data bases and processes are integrated, the DoD CM Manager could also monitor performance trends at the contractor.

While at the present time such a system is not a reality, partial solutions are currently being implemented building upon legacy systems that are in place. Legacy systems are typically more expensive to run because they require more interaction by personnel, redundant input, and more hands-on operational support and system administration. However, all of the information required to accomplish the complete CSA function can be captured and supplied using stepping stone implementations such as CMIS 5.0 (presently being deployed at a number of sites), and commercial configuration management and product data management tools (which promise to embrace the **MIL-STD-2549** data model). With appropriate links to logistics and maintenance systems, the following evolution of CSA information shown in **Table 5-1** is possible over the life cycle.

Some of the above status accounting inputs and outputs are routinely available in a contractor's data base, some are specialized information that the Government (or a third party contractor to the Government) would need to access. Other information is inherent to Government data bases and needs to be shared between Government and contractor. The amount and type of design information in the data base to which the Government needs access rights varies based on the documentation which the Government controls. The division of responsibility was simple when the Government baselined and controlled the Product Baseline on all weapon systems and organically supported each CI. In the environment of acquisition reform, the determination is more complex and cannot be made generically. The Government will control detailed design data only for specifically authorized items. Otherwise the Government will normally control only the performance requirements, which include interface and envelope requirements. The Government will take delivery of a technical data package (TDP) originals (and transfer CDCA responsibility) only if the Government baselines the configuration and acquires the TDP. If the Government chooses not to assume CDCA to the Government, it may elect to take delivery of a copy of the TDP to provide documentation for logistics support, modification analysis, demilitarization, and other purposes. **[Detail: Section 3.5.1, 3.7.1, 3.7.2]**

Table 5-1. Typical CSA Information Over The Acquisition Program Life Cycle

Program Phase	Typical Information Sources	Typical Outputs
0 - Conceptual Studies	• Mission need statements • Baseline performance/ cost/schedule goals • System requirements documents for alternative configurations • Engineering change proposals or contract change proposals, as applicable	• Current revision of each document • CDCA and approval status for each document
I - Program Definition & Risk Reduction	• Preliminary System Performance Specifications for selected configuration • Prototype design data • Test Plans, procedures & results • Engineering reports • Engineering change proposals or contract change proposals, as applicable	• Current revision of each document • Release date • CDCA and approval status for each document
II - Engineering & Manufacturing Development	• System performance specification • CI performance specifications • CI detailed specifications • Engineering drawings and associated lists • CAD files • Test plans/procedures • Audit plans • Audit reports • Audit certifications • Engineering change proposals • Request for deviation • NORS • Engineering orders, change notices, etc. • Installation and as-built verification • Removal and re-installation	• Release and approval status of each document • Current (Government and/or contractor) Functional, Allocated and Product baselines • Baselines as of any prior date • As-designed configuration, current and as of any prior date • As-built configuration, current up to time of delivery, and any prior date • As-delivered configuration • Status of ECPs, RFDs in process by contractor, by Government • Effectivity and incorporation status of approved ECPs, RFDs, including retrofit effectivity • Test and certification requirements to be completed prior to milestones such as reviews, demonstrations, tests, trials, delivery • Verification and audit status and action items
III - Production, Deployment & Operational Support	• All Phase II Items • System CI location by S/N • Support equipment and software • Spares • Trainers • Training Materiel • Operating and Maintenance Manuals, IPBs • CI Delivery dates and warranty data • Shelf life or Operating limits on components with limited life or limited activations, etc. • Operational history (e.g., for aircraft - take-offs and landings) • Verification/Validation of Retrofit Instructions, Retrofit Kits • Incorporation of Retrofit Kits • Installation of spares, replacements by maintenance action	• All Phase II items • Current configuration of all Systems/CIs in all locations (As-modified/As-Maintained) • Required and on-board configuration of all Support Equipment, Spares, Trainers, Training, Manuals, Software, Facilities needed to operate and maintain all systems/CIs at all sites • Status of all Requested, in Process and Approved changes and deviation requests • Authorization and Ordering actions required to implement approved changes, including recurring retrofit • Warranty status of all CIs • Predicted replacement date for critical components • Retrofit actions necessary to bring any serial numbered CI to the current or any prior configuration

The government's range of CSA access is normally limited to data for which they have configuration control for items for which they provide logistic support. The contractor normally monitors the data for those items it supports. Some of the information that must be shared concerns items under warranty. It is important for the Government to know what the warranty period is on each item that needs repair, as well as the date that the warranty began for each serial number. A ready reference to this data by logistics support personnel could result in cost savings to the Government if it is used to determine the priority used to ship items back to the manufacturer for repair. This is an instance of the Government adapting to standard industry practice.

New and innovative methods of capturing the configuration of installed and spare items and software versions are becoming commonplace. These methods include bar coding and the interrogation of embedded identification via on-equipment data busses and on-board support equipment. The technology for this process is now commonplace in the commercial personal computer industry and the automotive industry.

The information that is loaded into CSA is considered "meta-data", i.e. information about the data. It provides status and cross-references actual TDP information that is stored digitally in contractor and Government data repositories. Each design activity establishes a document repository for the CIs developed, produced or maintained by an OPR under their authority. The data repositories are normally maintained by the inventory control point responsible for the provisioning/supply support of the CI. (For example, the Weapon Systems Files (WSF) at the Ships Parts Control Center, Aviation Supply Office (ASO), and the DLA, Air Force and Army supply centers. Each DoD Activity responsible for a data repository would identify the repository by listing it in MIL-HDBK-331.) Current CSA records are maintained in such range and depth as to be responsive to the requirements of the various support activities for access to configuration information. The data repository is the central point for the collection, storage, processing, and promulgation of this data. Configuration information should be available on a request basis, either by hard copy or on-line computer access. The CSA records are used as "best source" input data for purchase data packages, design studies, and management analyses requested by the supporting/design activities. In particular, the CSA meta data records must accurately reflect the status of the configuration documents (specifications, drawings, lists, test reports, etc.) maintained in the document repositories.

MIL-STD-2549 facilitates the evolution from legacy systems and legacy data by providing a means to map current data fields to the conceptual schema, and to the common data fields that will enable exchange of CM information on a more universal basis. **[Details: Appendix B]**

5.3 CSA Activity Guides

Table 5-2 provides an activity guide for the evaluation of a configuration status accounting process.

Table 5-3 is an activity guide designed to aid the tailoring process for MIL-STD-2549 and to aid in clearly establishing the separate but interrelated domains of the contractor's status accounting process and the Government's status accounting process since each configuration status accounting task may be assigned to either the Government or a contractor. These guides, keyed to each of the tasks listed in Figure 5-1, provide:

- Inputs and outputs types (categorized by the generic input and outputs shown in **Figure 5-1**)
- Correlation to the information packets in **MIL-STD-2549**
- The life cycle phases during which the information is typically needed.

Table 5-2. *Activity Guide*: Configuration Status Accounting Process Evaluation Checklist

✓	Criteria
	1. Documented Process
	a. Does the contractor have a documented Configuration Status Accounting process?
	b. Does the contractor follow his documented process?
	c. Are contractor personnel from all disciplines involved in the process informed and knowledgeable about the procedures they are supposed to follow?
	2. CSA Information
	a. Has the contractor established an accurate, timely information base concerning the product and its associated product information, appropriate to the applicable phase(s) of the life cycle?
	b. Is configuration information, appropriate to the product systematically recorded and disseminated?
	c. Is applicable CSA information captured as CM tasks are performed, and is it available for display or retrieval in a timely fashion?
	3. CSA System
	a. Is the Contractor's data collection and information processing system based on, consistent with, the configuration status accounting information needs of the Contractor and of the Government?
	b Do the data elements in the contractors system map effectively to the Government's CM AIS, as reflected in the MIL-STD-2549 data packets tailored for application to the current phase of the program?
	c. Are the data relationships in the contractor's system based on a sound set of business rules?
	d. Are the contractors business rules consistent or compatible with the Government's, enabling an accurate transfer or sharing of information?
	4. Metrics
	a. Does the status accounting data being collected and the information system enable meaningful metrics to be developed and used to maintain and improve the CM process?

Table 5-3. *Activity Guide:* Configuration Status Accounting Tasks

Type of Input	Phase 0	Phase I	Phase II	Phase III	MIL-STD-2549 Information Packets[1]	Type of Output
❶ **Task Description:** Record the current approved configuration documentation and configuration identifiers associated with each system/CI(s)						
• Approved Configuration Documentation	✓ 2	✓	✓	✓	1, 3, 6, 7	• Configuration Information
❷ **Task Description:** Record and report the status of proposed engineering changes from initiation to final approval and contractual implementation						
• Change Identification, Documentation And Disposition			✓	✓	2, 4, 5, 6	• Status • Performance Measurement
❸ **Task Description:** Record and report the status of all critical and major requests for Deviation which affect the configuration of a system/CI(s).						
• Change Identification, Documentation And Disposition			✓	✓	4, 5, 6	• Status • Performance Measurement
❹**Task Description**: Record and report the results of configuration audits to include the status and final disposition of identified discrepancies and action items.						
• Action Items			✓	✓	5, 6	• Status • Performance Measurement
❺ **Task Description:** Record and report implementation status of authorized changes.						
• Approved Configuration Documentation • Change Identification, Documentation And Disposition • Configuration Verification • Change Verification & Validation			✓	✓	2, 3, 4. 5, 6	• Status • Configuration Information • Performance Measurement

1 The following data information packets and the associated DIDs must be tailored to select the applicable sub-packets and choose the optional data fields that are applicable in accordance with **MIL-STD-2549, Appendix A**. **(See Appendix B of this handbook for further Tailoring Guidance)**:

DIP1. Drawings, Specifications, Standards, Software and Software Support Documents data information packet /DID-CMAN-81551
DIP2. General Document data information packet/DID-CMAN-81552
DIP3. Product/Asset Configuration data information packet/DID-CMAN-81553
DIP4. Configuration Change Control data information packet/DID-CMAN-81554
DIP5. Configuration Management Action Status data information packet/DID-CMAN-81555
DIP6. Project Management data information packet/DID-CMAN-81556
DIP7. *Engineering Parts List data information packet
DIP8. *Basic Document Protection data information packet
DIP9. *Basic File Information data information packet
DIP10. *Basic Document Representation data information packet

(*The basic packets (7-10) are invoked via the other packets whenever documents are involved.)

2 Or other documentation informally controlled during this phase

Table 5-3. *Activity Guide:* Configuration Status Accounting Tasks

Type of Input	Phase 0	Phase I	Phase II	Phase III	MIL-STD-2549 Information Packets[1]	Type of Output
❻ **Task Description:** Provide the traceability of all changes from the original released configuration documentation of each system/CI(s)						
• Approved Configuration Documentation • Change Identification, Documentation And Disposition • Configuration Verification • Change Verification & Validation			✓	✓	1, 4, 6, 7	• Status • Configuration Information
❼ **Task Description:** Report the effectivity and installation status of configuration changes to all system/CI(s) at all locations, including design, production, modification, retrofit and maintenance changes.						
• Approved Configuration Documentation • Change Identification, Documentation And Disposition • Configuration Verification • Change Verification & Validation • Action Items				✓	1, 3, 4, 5, 6	• Status • Configuration Information • Performance Measurement
❽**Task Description:** Record the digital data file(s) identifiers and document representations of each document and software which has been delivered, or made accessible electronically in support of the contract.						
• Approved Configuration Documentation • Change Identification, Documentation And Disposition	✓3	✓	✓	✓	1, 2, 4, 6, 7, 8-10	• Status • Configuration Information • Performance Measurement

3 Or other documentation informally controlled during this phase

SECTION 6
CONFIGURATION VERIFICATION AND AUDIT

	QUESTIONS THIS SECTION WILL ANSWER	Para.
1.	What is configuration verification?	6.1, 6.2, 6.2.1
2.	How is the complete implementation of a change verified?	6.2.1
3.	What is a configuration audit? How does an audit differ from verification?	6.1, 6.2,
4.	How do audits and verification relate to such activities as ISO 9000 certifications?	6.2
5.	What are the different types of configuration audits? What do they determine?	6.2.2.1, 6.2.2.2
6.	What is the relative importance of the physical audit vs the functional audit?	6.2.2
7.	When are configuration audits necessary? When are they not?	6.2.2.3
8.	How detailed should an audit be?	6.3
9.	What are the common elements in any audit process?	6.3
10.	What are the roles, tasks, responsibilities of the Government, the contractor, and, if applicable the third party auditor?	6.3
11.	What part do certifications play in the audit process?	6.3

6.1 Configuration Verification and Audit Activity.

The configuration verification and audit process includes:

- Configuration verification of the initial configuration of a CI, and the incorporation of approved engineering changes, to assure that the CI meets its required performance and documented configuration requirements
- Configuration audit of configuration verification records and physical product to validate that a development program has achieved its performance requirements and configuration documentation or the system/CI being audited is consistent with the product meeting the requirements.

The common objective is to establish a high level of confidence in the configuration documentation used as the basis for configuration control and support of the product throughout its life cycle. Configuration verification should be an imbedded function of the contractor's process for creating and modifying the CI or CSCI. Validation of this process by the Government may be employed in lieu of physical inspection where appropriate.

As shown in **Figure 6-1**, inputs to the configuration verification and audit activity are:

- Configuration, status, and schedule information from status accounting,
- Approved configuration documentation (which is a product of the configuration identification process),
- The results of testing and verification,
- The physical hardware CI or software CSCI and its representation
- Manufacturing
- Manufacturing/build instructions and engineering tools, including the software engineering environment, used to develop, produce, test and verify the product

Successful completion of verification and audit activities results in a verified System/CI(s) and a documentation set that may be confidently considered a Product Baseline. It also results in a validated process to maintain the continuing consistency of product to documentation.

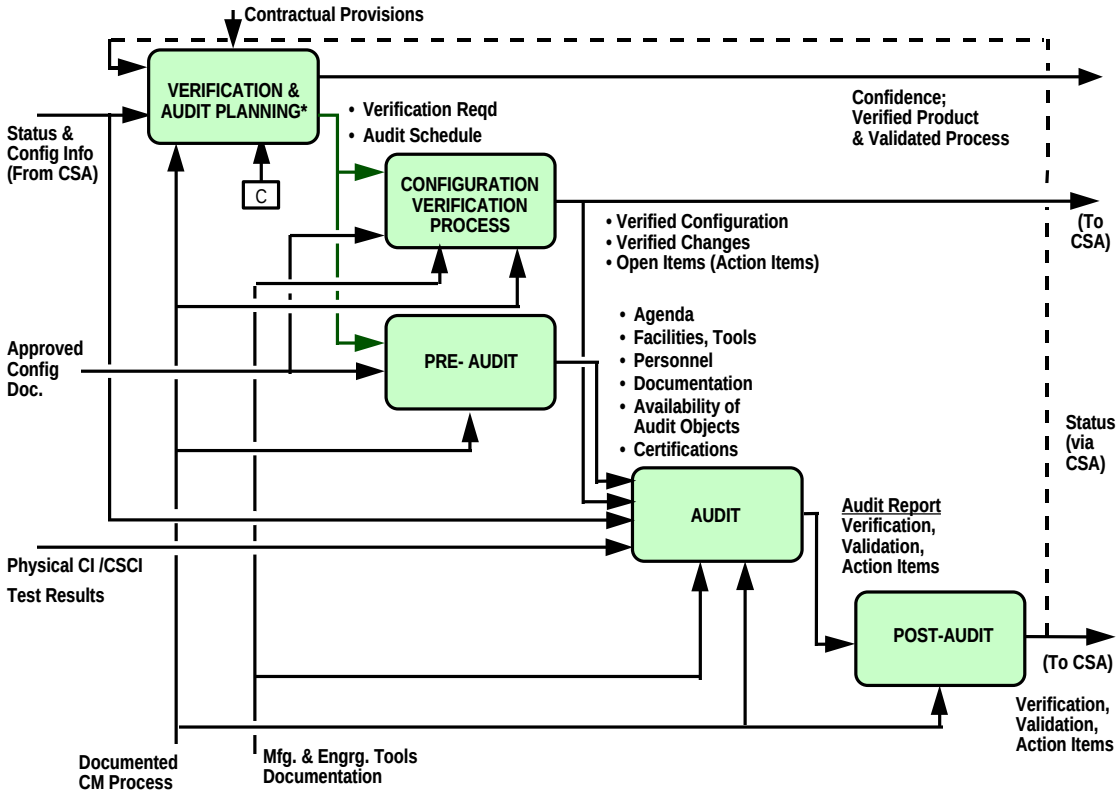


Figure 6-1. Configuration Verification and Audit Activity Model

6.2 Configuration Verification and Audit Concepts and Principles

There is a functional and a physical attribute to both configuration verification and configuration audit. Configuration verification is an on-going process. The more confidence the Government has in a contractor's configuration verification process, the easier the configuration audit process becomes. The reward for effective release, baselining and configuration/change verification is delivery of a known configuration that is consistent with it's documentation and meets its performance requirements. These are precisely the attributes needed to satisfy the ISO-9000 series requirements for design verification and design validation as well as the ISO 10007 requirement for configuration audit.

6.2.1 Configuration Verification.

Configuration verification is a process that is common to configuration management, systems engineering, design engineering, manufacturing, and quality assurance. It is the means by which a contractor verifies his design solution. The functional aspect of configuration verification encompasses all of the test and demonstrations performed to meet the quality assurance sections of the applicable performance specifications. The tests include verification/qualification tests performed on a selected unit or units of the CI, and repetitive acceptance testing performed on each deliverable CI, or on a sampling from each lot of CIs, as applicable. The physical aspect of configuration verification establishes that the as-built configuration is in conformance with the as-designed configuration. This verification is accomplished by the contractor through physical inspection, process control, or a combination of both.

Once the initial configuration has been verified, approved changes to the configuration must also be verified. **Figure 6-2**, illustrates the elements in the process of implementing an approved change.

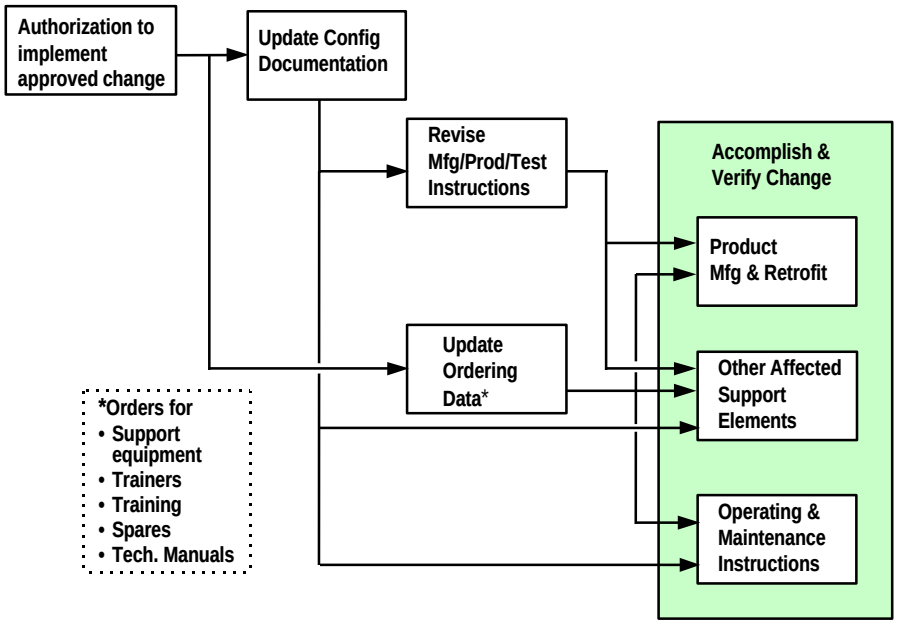


Figure 6-2. Change Implementation and Verification

Change verification may involve a detailed audit, a series of tests, a validation of operation, maintenance, installation, or modification instructions, or a simple inspection. The choice of the appropriate method depends upon the nature of the CI, the complexity of the change, and upon the support commodities that the change impacts. If the change is being introduced into a production line, and all future units will have the change incorporated via the production process, it is normally sufficient to ensure that:

- Manufacturing instructions contain the change and are released for use (as with a work order), and
- The first articles produced are inspected for compliance.

However, if support elements are impacted, or the change requires incremental retrofit to many units, complete implementation and verification of the change can be a lengthy process. Under these circumstances, implementation planning must define the extent to which the change to each unit and support commodity is to be verified; and the records to be maintained. When materials, parts, or retrofit kits are ordered in incremental stages (e.g., per year, per onth), the incremental ordering and supply actions should also be verified.

Retrofit changes to organically supported items are verified and reported to the Government's status accounting system by the activity given installation and checkout responsibility for the retrofit. Changes retrofit by the contractor for contractor supported items are verified by the contractor.

6.2.2 Configuration Audit

The dictionary definition of the word "audit" as a final accounting gives some insight into the value of conducting configuration audits. As has been discussed earlier in this handbook, configuration management is used to define and control the configuration baselines for the CIs and the system. In general, a performance specification is used to define the essential performance requirements and constraints that the CI must meet. When the performance specification is baselined, those requirements are contractual, so it is prudent for the Government to ascertain that the contractor has provided the expected performance capabilities. Since the development involves the generation of product documentation, it is prudent to ascertain that the documentation is an accurate representation of the design being delivered. To the extent that the Government is buying the CIs to approved detail specifications, the Government would perform this kind of audit. However, the design activity should audit all CIs in the deliverable product. The operation and life cycle support of the CI is based on this documentation. To fail to assure its accuracy can result in acceptance of items that will not perform as specified, or to greatly complicate future logistics support of the CI.

Configuration audits provide the framework, and the detailed requirements, for verifying that the contractor's development effort has successfully achieved all of the requirements specified in the configuration baselines. If there are any problems, it is the auditing activity's responsibility to ensure that all action items are identified, addressed and closed out before the design activity can be deemed to have successfully fulfilled the requirements.

There are three phases to the audit process, and each is very important. The pre-audit part of the process sets the schedule, agenda, facilities and the rules of conduct and identifies the participants for the audit. The actual audit itself is the second phase, and the third is the post-audit phase in which diligent follow-up of the audit action items must take place. For complex products such as major weapon systems, the configuration audit process is a series of incremental audits conducted over a period of time to verify all relevant elements in the weapon system product structure. The process will normally involve audits conducted by prime contractors on subcontracted items at subcontractor facilities with or without Government participation (at Government option) and audits of prime contractor developed items conducted by the Government at the contractor's facility. Each item may be subjected to separate functional and physical audits, or both may be conducted at the same time,.

6.2.2.1 Functional Configuration Audit. The Functional Configuration Audit (FCA) is used to verify that the actual performance of the CI meets the requirements stated in its performance specification and to verify that the CI has met those requirements. For systems, the FCA is used to verify that the actual performance of the system meets the requirements stated in the system performance specification. In some cases, especially for very large, complex CIs and systems, the audits may be accomplished in increments. Each increment may address a specific functional area of the system/CI and will document any discrepancies that are found in the performance capabilities of that increment. After all of the increments have been completed, a final (summary) FCA may be held to address the status of all of the action items that have been identified by the incremental meetings and to document the status of the FCA in the minutes and certifications. In this way, the audit is effectively accomplished with a minimum of complications.

Although an FCA is only required once for each CI or system, a number of FCA-like activities may be accomplished at other times during the life cycle of the CI or system. Many Class I ECPs incorporate a new design into the baselined design. The performance of each new design element must be verified to ensure that it will not degrade the performance of the CI or system. The degree and type of verification will be included as part of the ECP; it may vary from a simple analysis of the similarity to the old design to a lengthy program of testing similar to the original verification testing accomplished during the EMD phase. However, it is important to understand that a complete retest and FCA are not required for each ECP; only the verifications specified in the ECP are required.

a. A production contract may be issued with the requirement for a "first article" inspection to be accomplished. This would include more comprehensive "testing" than the normal production acceptance tests, and the test data resulting from the "first article" would be subject to a review process not unlike an FCA.

b. An ECP or a new contract may call for the development of a new CI(s) and incorporation of the new CI into the system via a modification program. The expected performance of the new CI would commonly be defined in a performance specification, and the results of the verification testing of the CI would be checked at an FCA. In addition, some retesting of the existing system elements with the new CI incorporated would normally be required, and those results would also be subject to a review similar to an FCA.

6.2.2.2 Physical Configuration Audit. The Physical Configuration Audit (PCA) is used to examine the actual configuration of the CI which is representative of the product configuration in order to verify that the related design documentation matches the design of the deliverable CI. It is also used to validate many of the supporting processes that the contractor uses in the production of the CI. The PCA is also used to verify that any elements of the CI that were redesigned after the completion of the FCA also meet the requirements of the CI's performance specification. In cases where the Government does not plan to control the detail design, it is still essential that the contractor conduct an internal PCA to define the starting point for controlling the production design and to establish a product baseline. Additional PCAs may be accomplished later during CI production if circumstances seem to warrant it. This is most common when the Government controls the CI detail design and:

- The original production line is "shut down" for several years and then production is restarted
- The production contract for manufacture of a CI with a fairly complex, or difficult-to-manufacture, design is awarded to a new contractor.

6.2.2.3 Application of Audits during Life Cycle. It is extremely unlikely that FCAs or PCAs will be accomplished during the Concept Exploration and Definition phase or the Program Definition and Risk Reduction phase of the life cycle. Audits are intended to address the acceptability of a final, production-ready design and that is hardly the case for any design developed this early in the life cycle. [NOTE: An activity similar to the FCA or the PCA might be accomplished during the PF/D&RR phase as a part of the completion of a competitive prototyping effort to facilitate the evaluation of the results of the competition.]

It is during the Engineering and Manufacturing Development (EMD) phase that the final, production and operationally-ready design is developed. Thus, this phase is normally the focus for the auditing activity. Either the Government or the contractor will conduct a PCA for each HW CI that has completed the FCA process to "lock down" the detail design by establishing a product baseline. Hardware CIs built during this phase are sometimes "pre-production prototypes" and are not necessarily representative of the production hardware. Therefore, it is very common for the PCAs to be delayed until early in the Production phase of the program.

Requirements to accomplish FCAs for systems and CIs are included in the Statement of Work (SOW) tasking. The FCA is accomplished to verify that the requirements in the system and CI performance specifications have been achieved in the design. It does not focus on the results of the operational testing that is often accomplished by operational testing organizations in the services. Deficiencies in performance capability, as defined in the baselined specification, result in FCA action items requiring correction without a change to the contract. Deficiencies in the operational capability, as defined in user-prepared need documents, may result in ECPs and/or contract changes to incorporate revised requirements into the baselined specifications or to fund the development of new or revised designs to achieve the operational capability.

Since the final tested software design verified at the FCA normally becomes the production design, the PCAs for CSCIs are normally included as a part of the SOW tasking for the EMD phase. CSCI FCAs and PCAs may be conducted simultaneously to conserve resources and to shorten schedules.

It is normal that the first production units in the Production, Fielding/Deployment and Operational Support Phase would be subjected to a PCA, which depending on whether the acquisition strategy was performance or detailed design based, would be conducted by the Government or by the contractor, respectively This PCA allow the establishment of a Product Baseline for the CI reflecting the design that is being delivered to the field and will require support. From a logistics support standpoint, it is essential that we have an accurate picture of the exact configuration; if we do not, we are likely to buy the wrong spares or to redesign the CI based on inaccurate information, leading to problems in the operation and/or support of the CI.

During a PCA, the deliverable item (hardware or software) is compared to the product configuration documentation to ensure that the documentation matches the design. This ensures that the exact design that will require support is documented. The intent is that an exact record of the configuration will be maintained as various repair and modification actions are completed. The basic goal is sometimes compromised in the actual operation and maintenance environment. Expediency, unauthorized changes, cannibalization, overwork, failure to complete paperwork, and carelessness can cause the record of the configuration of operational software or hardware to become inaccurate. In some situations, a unit cannot be maintained or modified until its configuration is determined. It is necessary to inspect the unit against approved product configuration documentation, as in a PCA, to determine where differences exist. Then the unit can be brought back into conformance with the documentation, or the records corrected to reflect the actual unit configuration.

6.3 Configuration Verification and Audit Activity Guides

Preparation for an audit is as important as the audit itself. **Table 6-1** provides guidance for planning and pre-audit preparation. **Table 6-2** and provides guidance for the conduct of physical and functional configuration audits. **Table 6-3** provides guidance for post-audit follow-up and close-out. **Figure 6-3** describes the content of audit certifications documenting key audit review activities. Refer to **Appendix E** for example certifications.

Activity Guide: Table 6-1. Audit Planning and Pre-Audit Preparation

Activity	
Responsibility	**Process - Action - Factors - Information**
Government. CM Planning	
Government	• Acquisition strategy for system/CIs is prerequisite to audit plans • Must determine level at which CIs will be acquired to performance or detail requirements; CIs designated for Government control
Request for Proposal	
Government	• State requirements for audit consistent with acquisition strategy
Contractor CM Plan	
Contractor	• Include proposed Government and internal audits; audit process • Expected schedule for audits (keyed to program events)
Scheduling Audits	
Contractor and Government	• Functional/allocated configuration documentation must be approved • Schedule compatible with availability of: items, information, personnel • FCA normally follows expected completion of CI/CSCI verification testing; prior to or concurrent with PCA • PCA requires an article in production (operational) configuration • Incremental HW PCAs typically shadow assembly or test sequence • SW PCA may be delayed until after integration testing • Take manpower constraints into consideration
Audit Planning	
Contractor Preparation, Government Approval	• Global plan & schedule for all FCAs PCAs expanding on CM Plan • CIs/CSCIs to be audited; specific units to be audited • Scope - contract requirements, SOW, specification, approved plans • Location and dates for each audit • Composition of Audit Team: Government, Contractor, Sub-Contractor and their functions in the audit • Documentation to be audited and Reference Material • Administrative Requirements; Security requirements
Audit Agenda	
Contractor, Coordinate with Government	• Covering a specific audit, targeted 60 days before audit • Date, time, location, duration - Unless otherwise specified configuration audits will be conducted at the contractor or a designated sub-contractor facility • Chairpersons: Government and contractor; sub-group chairpersons • Specific CIs or CSCIs • Documentation to be available for review • Chronological schedule for conduct of the audit • Detailed information pertinent to the audit, e.g. team requirements, facility requirements, administrative information, security requirements
Government Audit Teams	
Government	• Establish MOA between Program and participating agencies who will supply personnel with the requisite functional backgrounds • Assign a Government co-chair for each audit in audit plan • For FCA - Base specific personnel needs on the type and complexity of the CIs to be audited, their technical documentation, and the logistics, training, human factors, safety, produceability, deployability, and other requirements of the governing specification • For PCA - experts in engineering design, computer-aided design, engineering release, computer-aided manufacturing, manufacturing, assembly and acceptance test processes are needed. • Task DCMC plant representatives to review and certify engineering release, configuration control and verification processes • Prior to each audit, provide contractor with name, organization, and security clearance of each participating individual on the audit team

Activity Guide: Table 6-1. Audit Planning and Pre-Audit Preparation

Activity	
Responsibility	**Process - Action - Factors - Information**
Contractor Resources and Material	
Contractor	• Audit plan and agenda • Conference rooms • All requests for deviation against the CI, and their status • Minutes of prior audits • Personnel from engineering, manufacturing, and quality assurance • FCA ✓Matrix for each CI identifying specification sections 3 and 4 requirements cross-referencing: – Test plan, procedure and results for each requirement verified by test – Documented results of demonstrations, inspections, analyses verifying requirements ✓Applicable specifications, drawings, schedules, verification test plans and procedures, verification test results, documentation on demonstrations, inspections and analyses • PCA ✓Final draft copy of Configuration Item Detail Specification ✓FCA minutes ✓Engineering drawings, engineering/drafting manuals ✓Isolation of the item(s) (specific serial numbers) to be reviewed ✓Unencumbered access to facilities used for inspection, fabrication, production, assembly, testing ✓Access to all documents referenced by engineering drawings, inspection reports, process sheets and other applicable data ✓Tools and inspection equipment and test software necessary for evaluation and verification

Activity Guide: Table 6-2. Conducting Configuration Audits

Activity	
Responsibility	**Process - Action - Factors - Information**
Introductory Briefings	
• Government & Contractor co-chairs; • All participants	• Purpose of the audit • Specific items to be audited; pertinent information/characteristics of t the System/CIs • Basic criteria for problem identification and documentation • Schedule and location of audit events • Teams, team leaders, and location of teams • Administrative procedures for the audit; e.g. problem inputs format. processing flow, audit logistics • Location of necessary facilities
Conduct Reviews. Prepare Audit Findings (Problem write-ups)	
• Audit Sub-Teams: Team leaders	• Sub-teams facilitate the conduct of the audit by enabling parallel effort; auditors assigned to work in area of expertise • **FCA** - Review specification, verification processes and results ✓Test plans/procedures comply with specification requirements ✓Test results, analyses, simulations, etc. verify CI requirements as required by specification ✓ECPs are incorporated and verified ✓Interface requirements verified ✓Configuration documentation reflects configuration of item for which test data are verified ✓Data for items to be provisioned are sampled to assure that they reference applicable performance and test requirements ✓For CSCIs, • Data base, storage allocation, timing and sequencing are in compliance with specified requirements • Software system operation and maintenance documentation **[3.4.4, Table 3-9]** is complete • Test results and documentation reflect correct software version • Internal QA audits are satisfied - Temporary departures documented by approved Deviation Request • **PCA** - Product baseline ✓Formal examination of the as-built configuration of a CI or CSCI against the specifications and design documentation constituting its product baseline ✓Assure proper parts as reflected in the engineering drawings (see below) are actually installed and correctly marked ✓Determine that the configuration being produced accurately reflects released engineering data - Engineering drawing or CAD representations (design detail) review ✓Representative number of drawings (or CAD representations) and associated manufacturing instructions reviewed for accuracy and to assure that the manufacturing instructions (from which the hardware is built) reflect all design details and include authorized engineering changes • Drawing number and revision on manufacturing instructions matches correct released drawing or CAD representation • Drawing and revisions are correctly represented in release records; drawings do not have more than five un-incorporated changes • List of materials on manufacturing instructions matches drawing parts list • Nomenclature, part number and serial number markings are correct • All approved changes have been incorporated • There is a continuity of part references and other characteristics for a major assembly from the top drawing down to the piece part • Required approvals are present

Activity Guide: Table 6-2. Conducting Configuration Audits

Activity	
Responsibility	**Process - Action - Factors - Information**
	✓**Review the design details relating to any known hazard identified by the system safety program. [Ref: MIL-STD-882] NOTE:** *This may be of particular importance in establishing the "Government Contractor Defense[1]" in liability litigation* ✓Sampling of parts reflected on drawing reviewed to insure compatibility with program parts selection list (or criteria) - Acceptance test procedures and results ✓CI acceptance test data and procedures comply with item specification ✓Acceptance test requirements prescribed by the documentation are adequate for acceptance of production units of a CI ✓CIs being audited pass acceptance tests as reflected in test results - Engineering release and configuration control ✓System is adequate to properly control the processing and release of engineering changes on a continuing basis **[Ref: 3.7.1, 3.7.2, Table 3-12]** ✓Software changes are accurately identified, controlled and tracked to the software and documentation affected - Logistics support plan for pre-operational support ✓Spares and repair parts provisioned prior to PCA are the correct configuration - For CSCIs, ✓Documentation is complete and meets applicable conventions, protocols, coding standards, etc. ✓Software listings reflect design descriptions ✓Delivery media is appropriately marked and in agreement with specification requirements for packaging and delivery ✓Documentation the correct relationship to the components to which the software is to be loaded; For firmware, it contains complete installation and verification requirements ✓Demonstrate that each CSCI can be compiled from library based source code using deliverable or Government owned support assets, and be identical to the CSCI presented for audit and delivery ✓Review operational and support manuals for completeness, correctness and incorporation of comments made at prior reviews (FCA, test readiness, QA audits, etc.) - Examination of proposed DD-250 ✓Accurately reflects the product configuration of the items to be delivered ✓References approved deviation requests for all variances ✓All shortages and un-incorporated design changes are listed • **Problem Write-up** - Originator ✓Identify contract or configuration document ✓Item being audited ✓Requirement ✓Narrative description of the problem/discrepancy ✓Recommendation - Sub-team leader preliminary review ✓preliminary control number assigned ✓approved and signed ✓disapproved ✓returned to originator for revision or further analysis – If approved, forwarded to Executive Panel

[1] One of the tests applied by the courts to determine if the Government and Government contractor are liable is if the Government has participated in the design and has exercised discretion. such activities as design reviews and configuration audits are useful in documenting the Government's exercise of discretion over the design even though they have basically left the design solution to the contractor under acquisition reform principles.

Activity Guide: Table 6-2. Conducting Configuration Audits

Activity	
Responsibility	**Process - Action - Factors - Information**
Disposition Audit Findings	
• Executive Panel Audit Chairs – Key Govt & Ctr. Personnel – Selected Govt technical experts	• Executive Panel: – Final review of problem write-ups - Determine which problem write-ups should be submitted to the contractor - Assign control numbers and enter selected problems into official record of the audit - Submit to contractor with suspense time (typically a period of hours) for responding to the problem
• Contractor	• Contractor response - Concur with problem & recommend action - Offer additional information which resolves or clarifies problem - Disagree with problem finding or contractual obligation
• Originator & Team Leader	• Review response - Determine if it appears to provide satisfactory resolution - Provide to Executive Panel
• Executive Panel: - Key Govt & Contractor personnel	• Disposition all problem write-ups that were submitted to contractor • Make final decision as to further action - Close item - Agree on further actions by Contractor and/or Government necessary to close out problem • Officially record all dispositions, action assignments and suspense dates in audit minutes • Government and Contractor co-chairs sign all problem write-ups
Documenting Audit Results	
• Prepared by Contractor personnel • Signed by Audit co-chairs	• Prepare official audit minutes to include: - Typical meeting minutes: Time, place, purpose, participants, etc. - Action item lists reflecting all actions and suspenses agreed to - Applicable audit certifications documenting key audit review activities **[See Figure 6-3]** ✓Specific Items, systems, documents or processes reviewed ✓Summary of discrepancies/deficiencies in each area referenced to control number of applicable audit problem write-ups (action items) ✓Definitive statements about acceptability or non-acceptability ✓Final status of the contractor's effort in the area being certified

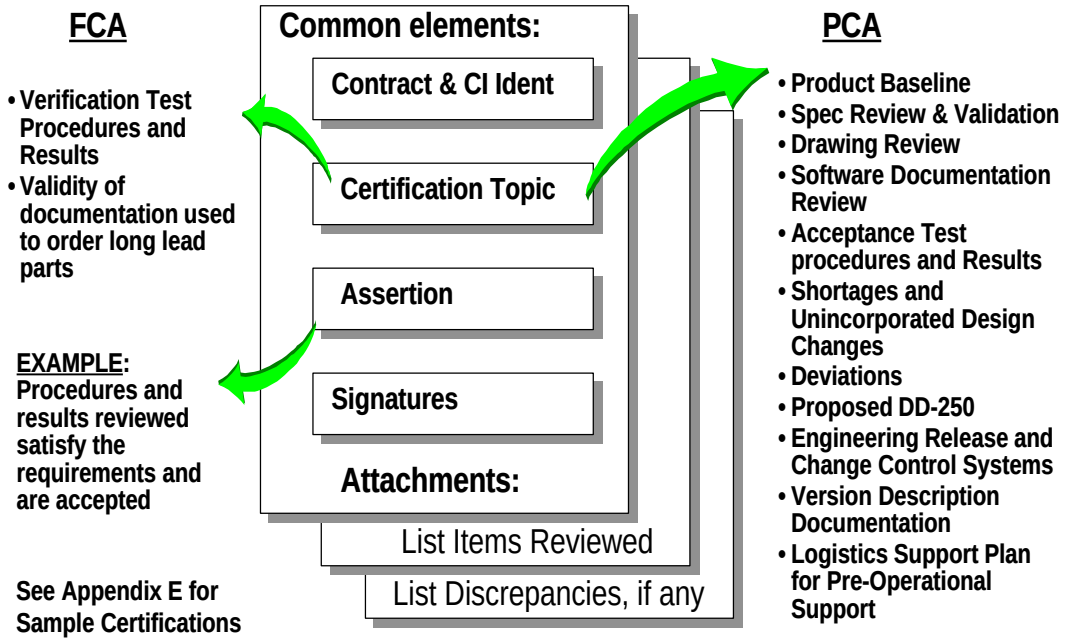


Figure 6-3. Audit Certification Package Content

Activity Guide: Table 6-3. Post Configuration Audit Actions/Audit Close-out

Activity	
Responsibility	**Process - Action - Factors - Information**
Completion of Actions	
Contractor(s) and Govt	• Take appropriate action to complete assigned action items within the designated suspense date • Report completion to audit chairpersons or other designee with objective evidence of completion
Audit co-chairs or their agents	• Periodically query responsible activities concerning status of their audit close-out related action items • Provide periodic report card to Government and Industry Program and Contract offices on progress of completion of all outstanding audit actions • Provide final summary at completion of all open actions

SECTION 7
DATA MANAGEMENT

QUESTIONS THIS SECTION WILL ANSWER		Para.
1.	What is the relationship between configuration management and data management?	7.1
2.	What principles of CM apply to the management of data?	7.2
3.	How does the conceptual schema in MIL-STD-2549 satisfy each of the above principles?	7.2.1-7.2.6, 7.3
4.	Is there any difference between configuration documentation and other technical data with regard to how it is managed?	7.1
5.	What digital data attributes are essential for an effective Government/contractor data interface?	7.2, 7.3
6.	What factors need to be considered when acquiring CM data from a contractor?	7.3

7.1 CM Related Data Management Activity

In this age of rapidly developing information technology, data management and particularly the management of digital data is an essential prerequisite to the performance of configuration management. Digital data is information prepared by electronic means and made available to users by electronic data access, interchange, transfer, or on electronic/magnetic media. There is virtually no data today, short of handwritten notes, that does not fall into this category. Configuration management of data is therefore part of data management activity; and management of the configuration of a product configuration cannot be accomplished without it.

Figure 7-1 is an activity model for configuration management of data. All of the activities shown apply to configuration documentation. Most of the activities apply to all data. The model illustrates that the process is driven by business rules established based on the Contractor process as adjusted to accommodate the Government's concept of operations for the processing of digital data, and specific contract data requirements. It assumes a data workflow that encompasses four progressive status categories of digital data files.

- Working data, where the data is under the originator's control only
- Released data, where working data has been approved by the contractor's established approval process, released for its intended use, and is now subject to contractor configuration control procedures
- Submitted data, where contractor released data has been formally submitted to the Government for approval
- Approved data, where contractor submitted data has been approved for its intended use by the Government

When the data process is initiated to create or revise an item of data, or to perform any of the actions necessary to bring it from one status level to the next, the various rule sets illustrated in the figure are triggered to facilitate the work flow. The result is a data product with:

- Appropriate document, document representation and data file identification,
- Version control,
- Clear and unambiguous relationships to the product configuration with which it is associated, and to the changes which delineate each configuration of the product

In addition, the data is available for access in accordance with contractually agreed to rules for submittal, transmission, or on-line access (as appropriate), in the prescribed format (document representation) that can be used by the application software available to the authorized user.

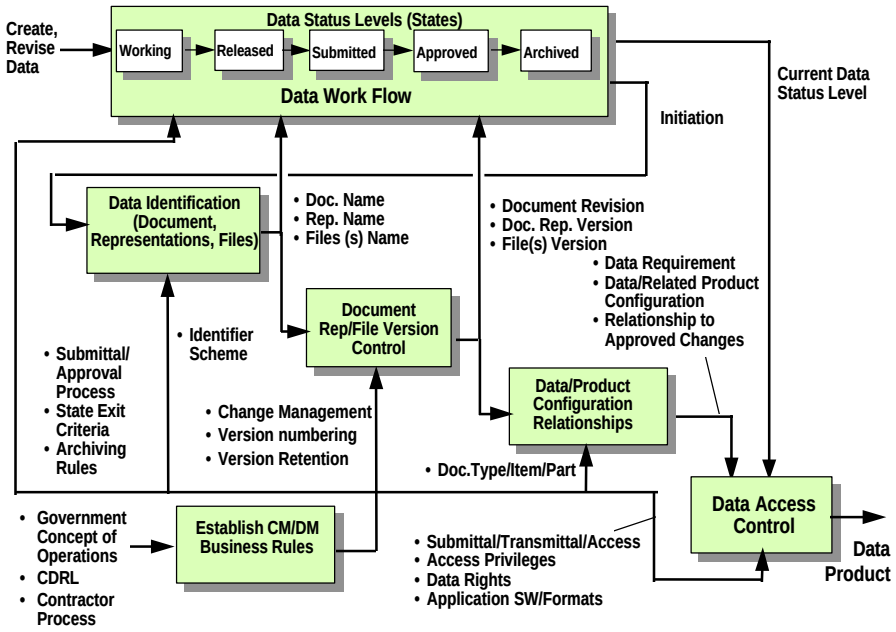


Figure 7-1. CM Related Data Management Activity Model

7.2 CM Related Data Management Concepts and Principles

Configuration management principles ensure the integrity of digital representations of product information and other data and enhance good data management practice. The concepts are described, as follows, based on elements and principles expressed in **EIA Standard 649**:

- Document identification
- Data status level management
- Data and product configuration relationships
- Data version control and management of review, comment, annotation, and disposition
- Digital data transmittal
- Data access control.

7.2.1 Document Identification

Each document reflecting performance, functional, or physical requirements or other product related information must be given a unique identifier so that it can be

- Correctly associated with the applicable configuration (product identifier and revision) of the associated item.
- Referred to precisely
- Retrieved when necessary.

With emphasis on the acquisition of commercial products and the use of industry methods, it is inappropriate for the military to specify one format for document identifiers. Except for MIL documents and program unique specifications, whose identifiers are governed by **MIL-STDs-961 - 963**, document identifier formats are determined by the document originators. Generally they include all or most of the following parameters:

- Date
- Assigned numeric or alpha numeric identifier unique to the document
- Revision indicator
- Type of document
- Title or subject
- Originator/Organization

This listing is substantiated by the following business rule for document identification in **MIL-STD-2549,: [Detail: Figure 7-3. Activity Guideline: Generic Document Identification]**

A document iteration is uniquely identified by a combination of

- Document source (CAGE code, organizational acronym, or company name)
- Document identifier (Number or title)
- Document type (Refer to **MIL-STD-2549 Appendix C, DED 0004**)
- Revision indicator (Letter, number or date)

A document is digitally represented by one or more electronic data files. Each document representation is the complete set of all the individual digital data files (e.g., word processor, CAD/CAM , graphics, database, spreadsheet, software) constituting one document.

As shown in **Figure 7-2**, the same document can have several different, equally valid, representations such as different word processing or standard neutral formats (IGES, ASCII, SGML-tagged ASCII,). Any individual file such as a raster graphics file, an ASCII file, or a spread sheet file may be part of several document representations of the same document/same revision; same document/different revision, or different document. The business rules defined in **MIL-STD-2549** relating documents, documentation representations and files are as follows:

1. Each document iteration exists as one or more document representations, identified by:
   - Document identifier
   - Document representation identifier
   - Document representation revision identifier

2. Each document representation is comprised of zero or more files

To facilitate the proper relationships, apply the following digital data identification rules to maintain document, document representation, and file version relationships.:

- Assign a unique identifier to each file
- Assign a unique identifier to each document representation
- Assign a version identifier to each file
- Maintain, in a database, the relationship between:
  - Document identifier and its revision level
  - Associated document representation(s)
  - File identifiers and versions
  - Retain multiple versions of files as necessary to recreate prior document revisions and provide a traceable history of each document
- Identify the tool, and version of the tool (e.g., msword 97) used to generate the document when the document is not in neutral format.

7.2.2 Data Status Level Management

Document status level **[See 7.1]** is important as a foundation for the business rules defining access, change management, and archiving of digital data documents. It is the basis for establishing data work flow management and enhances data integrity **[Refer back to Figure 7-1]** The standard data life cycle model shows the data status levels (also referred to as states) that a specific document/document revision is processed through in it's life cycle.

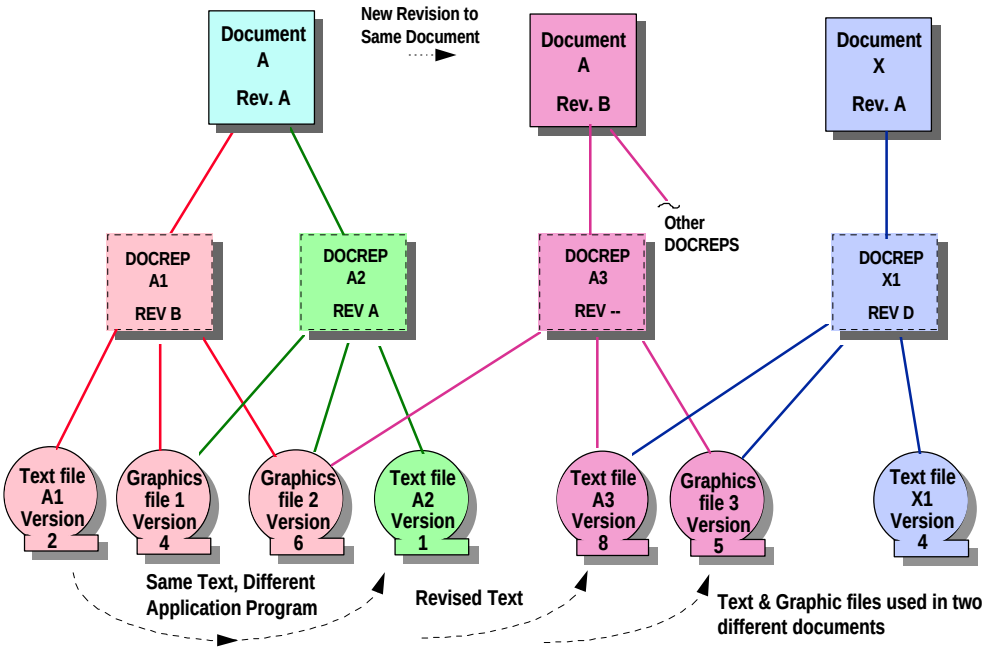


Figure 7-2. Illustration of Document Representation Concepts

These levels were initially defined in MIL-HDBK-59A (CALS Handbook, now cancelled). They were also defined in MIL-STD-974 "Contractor Integrated Technical Information Services (CITIS)" and in EIA Standard 649. The intent of the definitions in those documents has been preserved in MIL-STD-2549; however, the requirements of a precise data model have necessitated a number of enhancements to the concept and therefore a modification to the definitions. ***The key change is the concept of one or more document representations, and revisions thereto, for each document and document revision (see 7.2.1).*** The MIL-STD-2549 definitions of data status terms follow; the key changes from the previous definitions are highlighted and rationale for the differences is provided in the attendant footnotes:

- Working is the status used to identify data (***document representations*** [1] ***or document revisions***) that are in preparation - a work in progress that is subject to unilateral change by the originator. Each design activity may define any number of subordinate states within the working category, to define the unique processes that different document types go through before release in their organization.
- Released is the ***status of document representations, and revisions thereto,*** that have been reviewed and authorized for use or for submittal to, or access by, a customer (for example, the Government) or supplier. Released data are under originating organization (for example, a contractor) change management rules, which means that a new revision of the document representation cannot replace a released revision of a document representation until it has also been reviewed and authorized by the appropriate authority. ***The content of a document representation revision is fixed, once it is in the released state. It is only changed by release of a superseding document representation revision. Once a document (or document revision) is in the approved state, changes are made only by release of a new document representation related to the next document revision .***[2]
- Submitted data is either an ***approved document revision, or a proposed document revision with released document representation,*** which has been made available for customer review. This status applies only to data that requires submittal to or access by a customer (usually the Government).

[1] This change to the definition of working status recognizes the fact that there can be multiple representations of a document revision.

[2] This change to the definition of released status reserves the status of released for document representation revisions rather than document revisions. It allows the enterprise to release and iterate document representations without changing the document revision. Thus representations of proposed revisions to Rev A of a document may be reviewed, revised and reissued several times before a satisfactory Rev B (document) is issued.

1. If a submitted document revision, ***which has not been approved***, is commented to, or disapproved, a new working revision of the related document representation may be started and eventually ***replace the original document representation*** without affecting the identifier proposed for the new document revision.
2. If a submitted document revision ***which has been approved*** is commented to, or disapproved by the customer, a new working ***representation of the next document revision*** may be started and eventually ***replace the original document revision.*** [3]

- Approved is the status of documents and document revisions signifying that the data ***(document revision) has been approved by the CDCA of the document. The content of a document revision is fixed, once it is in the approved state.*** It is only changed by approval of a superseding document revision.
- Some tools which implement CM AIS include Archived as a data status for document representations and/or documents [4] This status is independent of the approval status (released, submitted, and approved) and ***merely means that has the data been removed from an active access storage mode***. [5]

No changes are allowed in the document representations that progress to the released state, or in document revisions that progress to the approved state. If there are changes to be made, they are accomplished by the generation and release or approval of a new revision. Documents must have at least one released document representation in order to be approved by the CDCA or submitted to a non-CDCA customer for review and adoption. Some data will exist only at the working level.

Business rules related to document/data status apply to each document type by defining requirements such as the following:

- Whether submittal to (or access by) customer(s) is required
- In which application software and data format is submittal/access required
- Who will be granted access privileges to the data in each of the applicable states
- What are the approval requirements (reviewers/approvers) and method of approval (e.g., electronic signature) to promote a document to the released state; the approved state
- What are the archiving rules for this document type (e.g., all released versions upon release of a superseding version, all released versions, 90 days after release of a superseding version, etc.)?

7.2.3 Data and Product Configuration Relationships

A product data management system must provide an effective system to maintain the key relationships between digital data, data requirements, and the related product configuration so that the correct revision of an item of data can be accessed or retrieved when needed. Data files are related to documents via document representations. **[Section 7.2.1]** Each product document, with a specific source, document type, document identifier (title, name and number) and document revision identifier, may have the following relationships:

- Program/project and/or contractual agreement
- Contract data item identifiers
- Document revision/change authorization
- Associated product (hardware or software) name
- Associated product (end item), part or software identifying number and revision/version identifier, where applicable

[3] This change to the definition of submitted recognizes that there are two conditions that apply to submitted data, approved data (see definition) and un-approved data. It also applies the concept discussed in footnote 2. The MIL-STD-2549 document approval paradigm does not put submitted sequentially after released. If the contractor is the CDCA, it may approve before submitting; it may approve without submitting, it may release a document representation as a draft of the new revision and submit it for review before approving the document. If the contractor is not the CDCA, it must release a document representation before submitting it to the CDCA for approval of the document revision.

[4] As did MIL-HDBK-59, MIL-STD-974, and EIA-649

[5] The revisions to the archived status definition simply recognize that archived is an indicator of the location of the data rather than a true status indicator. Archived is a tool/memory dependant condition that is not part of the MIL-STD-2549 conceptual schema.

- The effectivity in terms of end item serial numbers for the associated product, part, software item
- Status (working, released, submitted, approved, archived) of the data **[7.2.2]**
- Associated data - document name/document title/document revision number and date
- Associated correspondence - document number, subject, date, references

The business rules for document retrieval should use these key relationships within a database to assure the integrity of the data that users may extract. Thus information concerning a given product or part is associated with the configuration and effectivity (serial number) of the end item that uses the part. This capability is particularly significant during the operation and support phase, when data is needed to support maintenance activity and to determine the appropriate replacement parts for a specific end item.

7.2.4 Data Version Control

Disciplined version control of data files is the prerequisite to effective electronic management of digital documentation and must be encompassed within the product data management software. Version identification **[See 7.2.1]** occurs whenever a file is changed. The simplest form of version management is the file save feature incorporated in application software which advances the file date and time identification each time a file is saved. However to retain the superseded version, it must be renamed. True version control business rules require automatic version identifier advance whenever a file is revised and not when the file is saved without change. Furthermore, they require all versions to be retained, subject to archiving guidelines and special rules pertinent to specific document types.

Since a single document representation can consist of many files, a very disciplined process is necessary to manage a document review process electronically. Version control rules facilitate the establishment of an audit trail of comments and annotations by reviewers, and the disposition of each comment. Each version of each document representation provided to, or received from, each reviewer is uniquely identified and associated with the source of the comment. Essentially this means that a reviewer's version of a set of files (document representation) constituting a document being reviewed is re-named to enable the annotated comment copy to be distinguished from the official current version of the document. **[Detail: Refer to EIA-649]**

7.2.5 Digital Data Transmittal

Part of the obligation of the sender of any document, regardless of transmission method is to make sure that the document is in a format (document representation) that can be read by the receiver and converted to human readable form. Appropriate identification is affixed to media physical media such as floppy disks or tapes to clearly identify its contents. If all of the file identifications cannot be included on the label, a directory, reference to an accompanying listing or to a read.me file is used.

EIA-STD-649 lists the following the following common sense guidelines for information to be provided to the user (via such means as "read.me" files, reference to standard protocols, on-line help), where applicable:

- ✓ Identification of the files included in the transfer by file name, description, version, data status level, application/file type and application version.
- ✓ Applicable references to associate the data with the basis (requirement) for its transmittal, approval, and payment, where applicable
- ✓ If there are multiple files, such as separate text and graphics, how to assemble each included data item for reading, review or annotation, as applicable
- ✓ The naming convention for file versions and data status level which distinguishes altered (For example, annotated or red-line/strike-out) file versions from unaltered files.
- ✓ If and how changes from previous versions are indicated
- ✓ How to acknowledge receipt of the data, provide comments, and/or indicate disposition of the data digitally
- ✓ Time constraints, if any, relating to review and disposition.

7.2.6 Data Access Control

Access to digital data involves retrieving the appropriate files necessary to compile the correct version of each digital data document, view it, and perform the prescribed processing. Seeking digital data access should be as user-friendly as possible. Users should be provided with data/documents they are entitled to in the correct revision/version. Before this can be accomplished, there are a number of pertinent parameters concerning access privileges, security and protection of data rights that must be set-up.

Access privileges limit access to applicable users. Access privileges vary according to the individuals credentials (security clearance, need to know, organizational affiliation, etc.), data status level, the document type, program milestones, and the user need predetermined from the Government's concept of operations. Users of accessed data must respect all contractual and legal requirements for data rights, security, licenses, copyrights, and other distribution restrictions which apply to the data The applicable distribution code, which represents the type of distribution statement, must be affixed to a document or viewable file to indicate the authorized circulation or dissemination of the information contained in the item. **[Ref: MIL-STD-2549, Appendix C, DED 0014]**

Typically, working data should be made available only to the originating individual, group, or team (such as an integrated product development team); or to other designated reviewers of the data. If the Government is a direct participant in the team, the Government team members should be afforded the same access as the other members. In plant Government representatives have the right to request any and all data generated as part of the contract to which they have oversight responsibility; the contractor can determine the means of providing that access. With these exceptions, Government access to digital data (including data retrieved from databases) should be limited to contractually stipulated released, submitted, and approved data.

EIA-STD-649 provides us with the following checklist of ground rules to be pre-established prior to initiating interactive access (i.e., pre-defined query and extraction of data):

- ✓ How data is to be accessed
- ✓ Request for access and logging of access for read-only or annotation
- ✓ Naming of temporary working version of the file(s) for purpose of annotation/mark up
- ✓ Means of indicating whether a comment/annotation is essential/suggested
- ✓ Re-identification of marked up versions, as required
- ✓ Method of indicating acceptance, approval, or rejection, as applicable
- ✓ Time constraints, if any, on data acceptance
- ✓ Tracking of disposition of required actions
- ✓ Re-identification of changed files.

7.3 Data Management Activity Guides

7.3.1 Document Identification

Figure 7-3 which is a diagram of the generic document identification schema in **MIL-STD-2549** provides guidance in understanding the possible data identification relationships that the Government can expect to see when dealing with a variety of document originating from many different sources. Each document is identified uniquely by the combination of its source, its identifier, and its document type. A document identifier can include a number and a title, or either a number or a title. A numbered document may have a CAGE code, a company name, or an organizational acronym identifying its source. Certain document types are associated with each type of source.

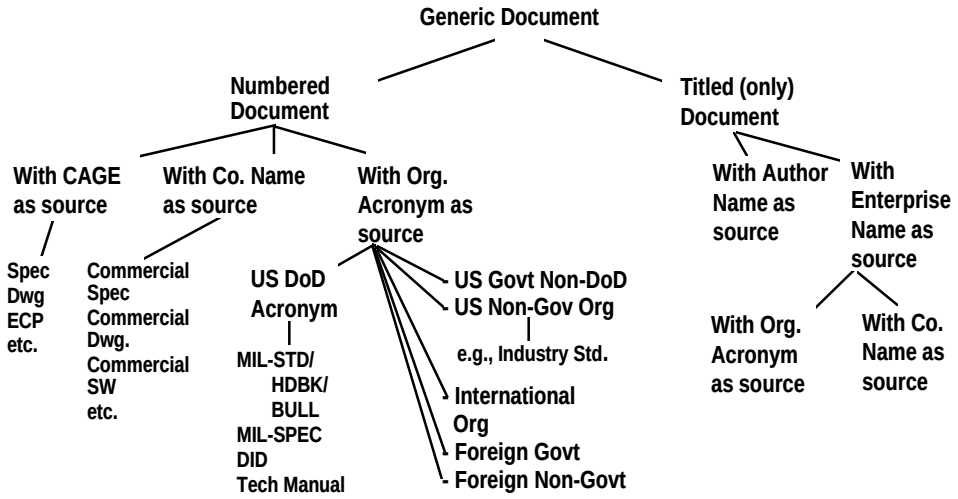


Figure 7-3. *Activity Guide*: Generic Document Identifier Characteristics

7.3.2 Configuration Management Data Acquisition Guidance

This section provides details on the actions required to define digital data for delivery to or access by the Government in general, and for configuration management data in particular. With interactive access, the emphasis is on Government access to contractor maintained data bases. It is most important to precisely define the requirements for digital data in the Contract data Requirements List (CDRL). **Figure 7-4** and **Table 7-1** models and provide explanation of the factors involved in defining a CDRL item for digital data.

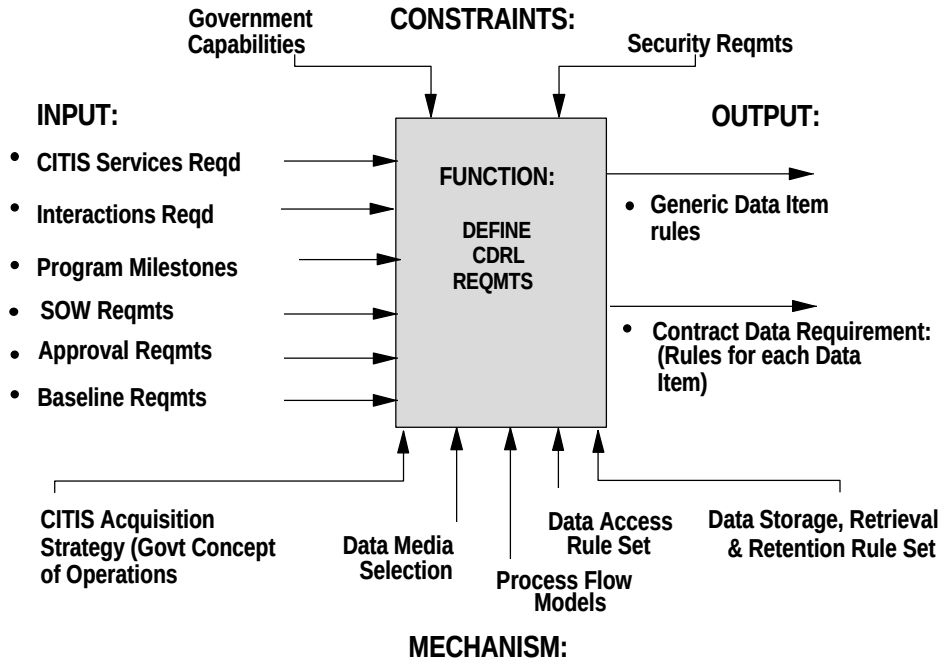


Figure 7-4. *Activity Guide*: CM Data Acquisition Definition Model

Table 7-1. *Activity Guide:* CM Data Acquisition Factors

Type of Factor/ Factor	Description	Considerations, Notes
INPUT		
• CITIS services required	A determination that documents will be required to be made available using Contractor Integrated Technical Information Services	The Government concept of operations and the Contract must call for CITIS services
• Interactions required	The actions that the Government intends to take with each particular type of data.	e.g., View, comment, approve, combine, download, edit, forward, query, sort
• Program milestones	Delivery requirement with respect to specific program events	e.g., 30 days prior to PDR
• SOW requirement	The statement of work task to which the data is associated, or which specifies a data task	
• Approval requirement	If the document(s) submitted pursuant to each CDRL are required to be approved by the Government or are merely for information purposes	Documents that are approved by the Government should be limited to Government configuration baseline documents, wherever possible
• Baseline requirement	Whether the document type when approved will constitute a Government configuration baseline	
CONSTRAINTS		
• Government infrastructure	The capabilities of each of the Government activities which need to view or use the data.	The means of data access (e.g., CITIS, direct input to CMIS, etc.) must be matched to the facilities, equipment and environment of the using community
• Security classification; data rights	Whether the data will be classified and to what levels of classification. Whether the Government anticipates that they will have unlimited rights to the data provided	These factors can influence the processing rules and choices of output media

Table 7-1. *Activity Guide:* CM Data Acquisition Factors

Type of Factor/ Factor	Description	Considerations, Notes
MECHANISMS/FACILITATORS		
• Government Concept of Operations	GCO identifies expected Government infrastructure at all of the participating sites and agencies	Influences services, media and access to be ordered
• Data media selection guidelines	Government preferences for types of media to be used for various document types	Helpful to have a pre-planned priority list of media preferences to match with contractor proposals
• Data work flow process	A work flow process defining the actions that Government will perform on data that is submitted or provided for access	Aides in determining necessary lead time. Documents Government process from submittal by contractor to disposition
• Data access rules	A set of ground rules that is agreed upon with the contractor governing both government and contractor access to data	Use to formulate specific access privileges
OUTPUTS		
• Generic data item rules	Defined set of business rules specific to the program to determine: • Data item life cycle processing • Data naming and revision/version scheme(s) • Means of change annotation revised data • Retention requirements for superseded data • Change authorization process • Validation of transmittal • Times of day/night that data will be accessible for Government use • Requirements for demonstration and certification of sender/receiver compatibility, indexing, accounting and audit trails	These rules apply to all CDRL items
• Specific data item requirements for each CDRL	Specification for the type of document representation required for delivery or access to each CDRL item including, as appropriate: • Media or access mode • Data representation form • Standards, specifications, protocols • If on-line service, the type of query, pre-defined, or ad-hoc • If pre-defined, a specification of or reference to a description of the queries/response formats	These rules apply individually to specific CDRL items

APPENDIX A
CONFIGURATION MANAGEMENT PLANS

QUESTIONS THIS APPENDIX WILL ANSWER?		Para.
1.	Why is a Government CM Plan necessary?	A.2, A.2.1
2.	What is the appropriate content for a Government CM Plan?	A.3
3.	How does the content differ from phase to phase?	A.3
4.	How should the Government CM Plan be used?	A.2.1
5.	How does the Government CM Plan differ from a contractor CM Plan?	A.2.2
6.	What should the content of a Contractor CM plan be?	A.3
7.	How should the contractor CM Plan be evaluated?	A.3

A.1 Scope.

This appendix provides guidance in the content, use and maintenance of Government configuration management plans. It also provides guidance in evaluating contractor CM plans. A.2 below contains basic guidance amplifying the text in Section 2. **[2.3.1]** It is followed in A.3 by activity guides delineating the content of both Government and Contractor plans.

A.2 Principles and Concepts

As described in Section 2, CM planning is a vital part of the preparation for the next phase of a program life cycle. The configuration management plan documents the results of that planning to enable it to be communicated and used as a basis in managing the program configuration management activities.

A.2.1 Government CM Plan.

The Government CM Plan may be documented as a standalone document, or it may be combined with other program planning documents. It has a two-fold purpose. The first purpose is to document the planning for the Government CM activity to take place during the upcoming phase and to schedule specific actions necessary to implement those activities. The second purpose is to communicate and coordinate the Government's intentions with the contractor or contractors involved in the program so that efficient and effective interfacing processes and working relationships may be established.

The government CM plan should be used as a repository for the ideas, schedules, actions and agreements that drive the activity during a given phase, including such elements as interface agreements, MOUs, system development, process documentation, operating procedures and training. Along with specific operating procedures, the CM plan provides guidance to the consistent application of CM across multiple integrated process and product development teams. It should also be used as a place to capture and evolve information that can be used to evaluate contractor activity, record specific experiences and document lessons learned.

EIA Standard 649 contains some practical guidance that is applicable for the Government as well as for contractors, as illustrated in **Table A-1**.

In preparing a Government CM Plan, it should not be necessary to "re-invent the wheel" for each phase of every program. Information developed in prior phases, and in prior programs can be used effectively as source material, where appropriate. However, a careful analysis of the needs of the particular phase is necessary to avoid the implementation of any activity that would not be value-adding. The CM Templates in Section 2 should be used as guides/shopping lists to aid in the selecting appropriate activities and metrics.

Table A-1. CM Principles Effected in Government CM Plan

EIA-649	Government CM Plan
Plan CM processes for the context and environment in which they are to be performed	• *The Government CM plan communicates to the contractor, the Governments CM objectives for a given phase and the associated risks if those objectives are not met* • *It describes the expected deployment and use of the system/CI* • *It indicates the CM process, systems, and methodologies the Government plans to use and the interfaces which the contractor will be expected to establish; specifically describes use of IPPD teams and PDM systems* • *It describes the acquisition strategy in terms of the types of CIs that the Government intends to support organically, and those for which Contractor Logistic Support (CLS) will be required; including preference for Commercial-Off- the-Shelf (COTS), as applicable* • *It reflects the Government's plan for baselining and configuration control* • *It describes the Configuration Status Accounting system that the Government will use in Phase III (Production, Fielding/Deployment and Operational Support)* • *It projects the anticipated configuration information needs of the Government; and the Government information infrastructure* • *It indicates the Government's strategy for conducting configuration audits; the degree of selectivity and the selection criteria* • *It provides (prior to Phase III) any special requirements for, activities to occur at the end of production and at demilitarization and disposal of items at the end of the phase such as environmental waste issues, and any records that must be maintained*
Assess the effectiveness of CM Plan implementation and performance of the CM discipline with defined metrics,	• *The Government CM plan should lay out the metrics that the Government will use to measure the effectiveness of the Government internal CM process and the contractor CM process.*

Activity Guide: Table A-2 provides a topic by topic compendium of the subject matter that should be considered in preparing a Government CM plan for each of the four phases of a program life cycle. As with the configuration documentation, the CM Plan evolves from broad conceptual ideas for Phase 0 and Phase I to specific descriptions of mature and proven processes in Phase III.

A.2.2 Contractor CM Plan

In the past, the Government stated its requirements in RFPs by reference to MIL-STDs. Even though tailoring of the MIL-STD was mandatory, it was often inadequately done. The contractor responded with a plan that cited compliance to the MIL-STD without disclosing significant details of how that compliance was to occur.

The current environment is quite different. The Government states its formal requirements succinctly in the form of a Statement of Objectives The contractor responds with a proposal containing a description of the processes that will be implemented and a SOW scoping the tasks to be performed. Seldom, however, particularly on major programs, are the formal proposal requirements the whole story. Typically there are several rounds of draft RFPs and communications sessions between Government and Contractor prior to the formal issuance of RFPs. The Government program personnel must complete their planning early in this cycle and can benefit from review and coordination with counterpart contractor personnel. Thus the content of the Government CM Plan should be known to the contractor. The contractor also formulates his planning in a similar time frame in order to be prepared to compare notes and provide meaningful input to the Government.

The Contractor's CM Plan, prepared or revised for a given phase, should reflect compatibility with the Government's plan. While both plans contain some common topic areas, they are addressed from different perspectives. The contractors CM plan also has a dual purpose. One purpose is to provide the framework for the contractor's application of CM on the specific program in order to manage the configuration of the product in a prudent and efficient manner. The other purpose is to provide the Government with assurance that the Government interfaces and information needs will be satisfied, and that a product of known and documented configuration will be delivered, and in many cases maintained. The CM Plan should describe the contractor's CM objectives, the value adding CM activities that will be employed to achieve them, and the means of measuring and assuring that they are effectively accomplished.

There have been many definitions of CM Plan content over the years. They evolved into Appendix A of MIL-STD-973, a consensus description coordinated with industry and Government. EIA Standard 649 contains a briefer generalized description of CM plan content without dictating any specific sequence of information. Any CM Plan outline consistent with either guidance should be acceptable if it conveys information at an appropriate depth for the specific program environment.

Activity Guide Table A-3 should provide no surprises to the experienced CM practitioner since it is essentially the same as the MIL-STD-973 outline. Acquisition reform does not impact the selection of topics to be discussed, although it may affect the textual content.. As with the Government plan, the Section 2 CM Templates for each phase, provide guidance in evolving the specific objectives, activities, information and metrics to be described in the plan.

A.3 CM Plan Activity Guides.

The following activity guides are intended to assist the Government CM Manager in preparing the Government CM Plan and in evaluating the Contractors CM Plan.

Activity Guide: Table A-2. Government CM Plan Content

Section Title	
Section Content	**Phase by Phase Guidance**
Section 1. Introduction	
• The purpose and scope of the configuration management plan and the program phase(s) to which it applies • A brief description of the system or top level CIs • Reference to applicable directives or glossaries containing definitions of terminology and acronyms used in the plan	• Phase O - Focus on the long range conceptual view of the life cycle • Phase I - Update long range view; focus on near term program definition and risk reduction; plan for development, production and support • Phase II - Finalize conceptual vision; focus on the development effort and requirements for production and support • Phase III - Focus on Production, support, deployment , demilitarization and disposal
Section 2. Reference Documents	
• List of the specifications, standards, manuals and other documents, referenced in the Plan by title, document number, issuing authority, revision, and as applicable, change notice, amendment , and issue date	• Same for all phases, where applicable
Section 3. Government CM Concept of Operations and Acquisition Strategy	
• CM Concept of Operations - A description of the Government's CM objectives ✓ Rationale for the objectives ✓ Relation to program objectives ✓ Risks associated with not meeting objectives ✓ Measurement/criteria for assessing accomplishment - Information needed to support the achievement of objectives in the current and future phases • CM Acquisition Strategy - The Government Acquisition Strategy for the System/CI(s) ✓ Identified by Government or Contractor? ✓ How will the selection of CIs proposed by contractor be approved? ✓ Expected deployment and use by the operating forces ✓ Organic or Contractor Logistic Support ✓ Governments intentions with respect to baselining and Configuration Control ✓ Life cycle operational and maintenance needs that the CM approach needs to satisfy - To what level are performance specifications required? ✓ Government or contractor preparation ✓ Government or contractor approval - What level of configuration identification required by the Government; By the Contractor? - What level of Government Configuration Control is necessary in the current phase? - What baselines will be established? ✓ What documents need to be included in those baselines? ✓ Who will be the control activity for those baselines? - What status accounting tasks are necessary? ✓ Who should perform those tasks? Government? Contractor? - To what extent should Government and contractor data be digital? on-line access? Paper?	• **[Ref: Section 2, Para. 2-3]** • For each phase, reflect the common understanding between the Government and the contractor concerning the factors required to implement complementary CM processes • Information to facilitate selection of the appropriate value added activities and actions for each phase

Activity Guide: Table A-2. Government CM Plan Content

Section Title	
Section Content	**Phase by Phase Guidance**
Section 4. Organization	
• Description and graphic portraying the Government's planned organization with emphasis on the CM activities, including: - The relationships of the Government project organization, IPT structure, functional organizations, prime and subordinate contractors - Identification of the program/project individual responsible for CM (hereinafter referred to as the Government CM Manager) - The relationships with related Commands, or Service Components and how the relationship is defined, e.g. the establishment of MOUs or other forms of working relationships. - Responsibility and authority for CM of all participating groups and organizations including ✓ Their role in configuration control boards ✓ The integration of CM functions with other program activities ✓ Interfaces with the Government CM Manager	• In Phases 0 and I, the Government's CM organizational focus is on establishing appropriate interfaces, and planning for Phase II and III • In Phase II the focus is implementation of a comprehensive Government CM Process, training, and establishing an effective team environment with contractor(s), and DCMC on-site representatives • Phase III the relationships should focus on control necessary for production, life cycle support and transition to a maintenance environment
Section 5. Data Management	
• Technical data concept of operation including such elements as: - CALS/CITIS implementation including data transfer and format standards and protocols - Specific information needs - Access requirements - Formats supported - Network interface parameters - Data base model	• A phased approach to Continuous Acquisition and Life Cycle Support (CALS) planning and implementation - provides the capability needed in each phase, and - Introduces technology improvements in each phase
Section 6. Government Configuration Management Process	
• Description of the Government CM process for accomplishment of the following (underlined) Configuration Management activities and: - Applicable Government and Government/Contractor CM actions - Selected decision criteria, and evaluation factors, where applicable - Metrics, if any, and their relation to CM Objectives (Section 3) • <u>CM Planning and Management</u> - In addition to applicable actions, description and graphics portraying CM phasing and milestones, i.e., milestones for implementation of the Government CM process in phase with major program milestones and events, including as a minimum: ✓ CM Activities for the current phase ✓ CM Activities and selected actions for future phases ✓ Establishment of interface agreements and MOUs ✓ Establishment of Government CCB ✓ Approval of configuration documentation establishing Government Functional, Allocated and (where applicable) Product Baselines ✓ Implementing Government CM AIS ✓ Conducting major configuration audits - Upon Update of the plan, record completion of actions and document lessons learned • <u>Configuration Identification</u> • <u>Configuration Control</u> • <u>Configuration Status Accounting</u> • <u>Configuration Audits</u>	• **[Ref: Tables 2-1 through 2-4]** • Recognize the global nature (applicable to all phases) of the following types of actions: - Preparation for the next phase - Implementing the Government CM Process - Measuring and evaluating both the Government and the Contractor's CM Process - Effecting process improvements and documenting lessons learned **[Refer to Section 2, Para. 2.3]**

Activity Guide: Table A-3. Contractor CM Plan Content

Section Title	
Section Content	**Phase by Phase Guidance**
Section 1. Introduction	
• The purpose, scope and specific contractual applicability of the configuration management plan and the program phase(s) to which it applies • A brief description of the system or top level CI, and of the component lower level CIs, using approved CI nomenclature when available, to which the CM Plan pertains • Reference to applicable directives or glossaries containing definitions of terminology and acronyms used in the plan • A description of the plan's major features and objectives and a concise summary of the contractor's approach to CM, including any special conditions (such as large number of organizations, security constraints, inter-operability constraints, unique contracting methods, non-developmental items, etc.) upon which the approach is based.	• Phase O - Focus on the near term conceptual studies, and provide long range conceptual view of the potential Phase I, II and III • Phase I - Focus on the near term program definition and risk reduction; planning for development and the long range conceptual view of production and support • Phase II - Focus on the development effort and the requirements for production and support • Phase III - Focus on Production, support , deployment and eventual demilitarization and disposal
Section 2. Reference Documents	
• List of the specifications, standards, manuals and other documents, including contractor policy directives, referenced in the Plan by title, document number, issuing authority, revision, and when applicable, change notice, amendment number, and date of issue.	• Same for all phases, where applicable
Section 3. Organization	
• Description and graphic portraying the contractor's organization with emphasis on the CM activities, including: - The relationships and integration of the project organization, IPT structure and functional organizations - Responsibility and authority for CM of all participating groups and organizations including their role in configuration control boards, and the integration of CM functions with other program activities - Identification of the CM organization and its responsibilities; - Interfaces between the CM organization and the tasking activity, subordinate performing activities, and associate performing activities.	• Essentially the same for all phases with some differences in emphasis • In Phases 0 and I, the emphasis should primarily be on support for the systems engineering process. • In Phase II the emphasis should shift to include the interplay with engineering and manufacturing development activities in the IPT environment and the need to support the product after delivery • In Phase III the organizational relationships and authorities should reflect control necessary for production and support and a transition to a maintenance and disposal environment
Section 4. Configuration Management Phasing and Milestones	
• Description and graphics portraying the sequence of events and milestones for implementation of CM in phase with major program milestones and events, including as a minimum: - Release and submittal of configuration documentation in relation to program events (for example technical reviews) - Establishment of internal developmental configuration and contractual baselines - Implementation of internal and tasking activity configuration control - Establishment of configuration control boards - Implementation of a status accounting information system and provision of reports/or access to the status accounting information, and - Conduct of configuration audits.	• During phases 0 and I, configuration control should be informal; baselining should be for convenience in defining known configurations at key points. • Most of the milestone phasing in the first column should occur in Phase II, where the full scale development, testing integration and audits take place • Most of the milestones should be achieved by the start of Phase III . Typically phase III milestones and events are somewhat repetitive unless there is planned product improvement. Careful consideration should be given to the end portions of this phase.

Activity Guide: Table A-3. Contractor CM Plan Content

Section Title	
Section Content	**Phase by Phase Guidance**
Section 5. Data Management	
• Description of the methods for meeting the configuration management technical data requirements in the Continuous Acquisition and Life Cycle Support (CALS) environment	• In all phases, this section should reflect an understanding of the Governments concept of operation, discrete information infrastructure and specific information needs
Section 6. Configuration Identification	
• The contractor's configuration identification process and procedures, including, as applicable: - Recommendation of system elements as candidates for designation as CIs (HWCIs and CSCIs) - Maintenance of developmental configuration including document, drawing and software development libraries and corrective action process - Recommendation and generation of the configuration documentation required for the Functional, Allocated and Product baselines and graphic illustration of configuration documentation relationships - Release and correlation of manufactured products - Assignment and application of configuration identifiers including document numbers, nomenclature, serial numbers, and part numbers and software identifiers to hardware, software and firmware	• In Phases 0 and I, the configuration identification process would focus on technical reports, conceptual configurations and design, test and simulation models. • In Phases II and III all of the configuration attributes in the left column apply
Section 7. Interface Management	
• The procedures for identification of interface requirements, establishment of interface agreements, and participation in interface control working groups (ICWG).	• This process applies to a degree in all phases • Phases 0 and I teaming agreements should contain provisions for interface definition and protection of proprietary information
Section 8. Configuration Control	
• This section shall describe the contractor's configuration control procedures including, as applicable: - Functions, responsibility, and authority of configuration control boards; - Classification of changes, and the level of authority for change approval/concurrence - Processing of Class I Engineering Change Proposals (ECPs) and Value Engineering Change Proposals (VECPs) - Processing of Class II ECPs - Processing of Requests for Deviation (RFDs) - Processing of Notices of Revision (NORs)	• In Phases 0, configuration control will typically be limited to a release and notification process • In phase I configuration control would be expected to continue to be informal • In phase II, the configuration control process should formally start as soon a functional baseline is established and should continue for the life of the program thereafter.
Section 9. Configuration Status Accounting	
• Contractor's procedures for configuration status accounting, including, as applicable: - Methods for collecting, recording, processing and maintaining data necessary to provide status accounting information via reports and/or database access; - Description of reports/information system content related to, as applicable: ✓ Identification of current approved configuration documentation and configuration identifiers associated	• The focus of configuration status accounting information evolves through the phases of a program • In Phase 0, the focus is on conceptual studies and analyses • In Phase I, the focus is on the evolving program definition documentation • In phase II, the focus is initially on specifications

Activity Guide: Table A-3. Contractor CM Plan Content

Section Title	
Section Content	**Phase by Phase Guidance**
with each CI ✓ Status of proposed engineering changes from initiation to implementation; ✓ Results of configuration audits; status and disposition of discrepancies ✓ Status of requests for critical and major deviations ✓ Traceability of changes from baselined documentation of each CI ✓ Effectivity and installation status of configuration changes to all CIs at all locations. - Methods of access to information in status accounting information systems and/or frequency of reporting and distribution.	and design documents, then shifts to include product configuration, as well • During Phase III, the focus encompasses the product configuration and the configuration of all associated support elements
Section 10. Configuration Audits	
• Contractor's approach to including, as applicable, plans, procedures, documentation, and schedules for functional and physical configuration audits; and format for reporting results of incremental or completed configuration audits.	• The configuration audit requirements typically pertain to Phases II and III
Section 11. Subordinate Performing Activity/vendor Control	
• Methods used by the contractor to ensure the effectiveness of subcontractor and vendor configuration management processes	• Typically applicable in Phases II and III. Applicable in phase I where necessary to support test and simulation hardware and software.

APPENDIX B
INTERPRETING AND TAILORING MIL-STD-2549

	QUESTIONS THIS APPENDIX WILL ANSWER	Para.
1.	What is the purpose of the data model?	B.2
2.	What is a data model? What elements comprise the model?	B.2, B2.1-B2.3
3.	How does the data model aid in the communication of configuration management information?	B.2, B.2.1-B.2.3
4.	How can the Government acquisition manager specify the configuration management information requirements to be included in an RFP/Contract?	B.3
5.	How can a contractor's automated configuration management system be evaluated to determine if it is adequate to meet the Government's information needs?	**[See 5.3]**

B.1 Scope.

This appendix provides guidance on the use of **MIL-STD-2549**. **MIL-STD-2549** has two distinct purposes. The first purpose is to provide a standard conceptual schema or data model for the Government CM Process. The second purpose is to provide the means of defining specific information to be directly input into a system designed in accordance with the data model, known as a CM AIS, by tailoring the information packets defined in **MIL-STD-2549**.

The Integrated Definition (IDEF1x) modeling technique used to define its configuration management data model is explained for a functional manager (as opposed to a data processing professional). Only those aspects of IDEF1x modeling necessary to read and interpret the key based entity relationship level (**MIL-STD-2549 Appendix B** Figures) and the fully attributed level (MIL-STD-2549 Appendix B Tables) are discussed. **[For a detailed exposition on IDEF1x refer to FIPS 184.]**

Guidance for tailoring the information packets defined in **MIL-STD-2549** is provided in **Section 6 and Appendix A of MIL-STD-2549**. This Appendix, in conjunction with **Section 5** of this handbook, provides additional guidance and examples to aid in the appropriate selection of the applicable sub-packets necessary for given configuration management information to be supplied.

B.2 Data Model Principles and Concepts

An IDEF1x data model depicts information requirements within a defined scope. It answers the question, "What kinds of information must be available to perform a defined task?" The model is not a system design, nor does it reflect the user interface, rather as shown in **Figure B-1,** it is the conceptual basis for both, known as a conceptual schema.

A conceptual schema is considered a logical data base as opposed to a physical database because it explains logical relationships. Like a performance specification for a product, it enables different solutions (physical data bases) to be implemented. Its purpose is to standardize the information elements so that data can be shared between the Government and any other user systems that employ the schema, regardless of their specific individual system data base designs. Additionally it provides a basis for mapping an existing system's elements to the Government's information requirements.

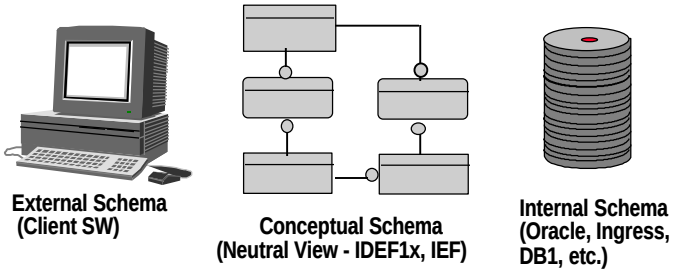


Figure B-1. Role of the Conceptual Schema

B.2.1 Specific Concepts, Features and Business Rules in the CM Data Model

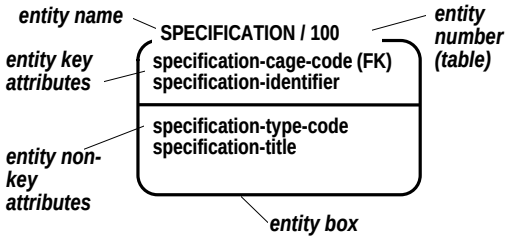
Specific concepts, features and business rules of the CM data model that may be helpful in understanding some of its complex relationships are as follows: **[Detail: MIL-STD-2549, Section 4]**

- **Current Document Control Authority** (CDCA) and **Application Activity** concept **[See 4.1.1.1]**
- **Document/Document representation** paradigms
  - A document is uniquely identified by a combination of document source (e.g., cage code), document identifier (number or title) and document type plus a revision identifier
  - Each document iteration (revision) has one or more document representations **[See 7.2.1]** which are identified by a document representation identifier and document representation revision identifier in addition to the unique identifier of the document that it represents
  - Each document representation is composed of zero or more files (a paper representation has no files but the word processing file that produced it does)
  - The same file can be used by different documentation representation revisions of a given document as well as by representations of a different document.
- **Generic document concept - [See 7.3.1]**
- **Part paradigm**
  - A part is any physical item identified by its design source and a part identifier
  - A physical part is always defined by an associated design document or model. Part models have revisions (versions) and associated files
  - A part identifier; the part identifier can be, but typically is not, the same as the identifier of the design document or model. The design document revision identifier is not part of the part identifier if the design source is a CAGE or an organization, but may include it if the design source is a company name.
- **Software paradigms**
  - For purposes of Configuration Management and data storage, software is treated by the data model as though it were a document rather than as a part. Conceptually software is considered a document of the type “software."
  - Software relationships are captured by the data model only at the end item (CSCI) level
  - Each software revision (version) is identified with a revision identifier
  - Source and executable code are treated as different document representations of the same software revision

For hardware/software integration, software is treated as a part and there are alternate paradigms to allow for different methods of identification and iteration that are commonly in use commercially

B.2.2 Model Representation and Components.

The IDEF1x standard defines the standard way the elements of the data model (entities, attributes and relationships) are represented in the components of the model (entity tables, graphic entity relationship diagrams and the data element dictionary). **Figures B-2 through B-8** illustrate how to interpret the information in each of these components. ***The content of these examples, such as entity and attributes names and table numbers, are used for illustrative purposes only; they may differ considerably from the actual content of MIL-STD-2549.*** For those familiar with physical databases, it is also important to note that entities and attributes in the conceptual (logical) database) do not map one-to-one to physical databases and fields, but are similar in concept.



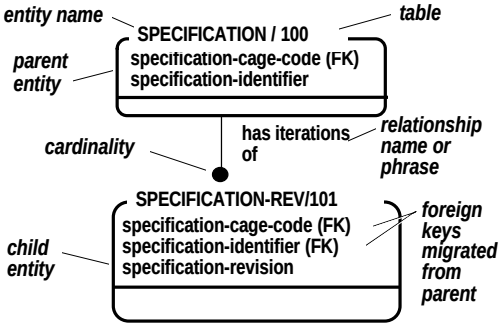
- **Entities** - Objects such as people, places, things, or concepts about which information is maintained.
  - » Entities are diagrammed as **boxes** with the **entity name** and **entity table** reference number **[See Figure B-6]** above the box. Each **entity box** has a corresponding Table.
  - » A **square-cornered box** is an independent entity - identified by one or more **key attributes** (keys).
  - » A **round-cornered box** is a dependent entity identified by one or more keys **inherited** from another entity.
- **Entity Names** - Each entity in the diagram is uniquely named with singular nouns or compound (hyphenated) noun phrases which capture the concept or idea of the entity. Entities names are shown in upper case letters,
- **Entity Example -** The entity SPECIFICATION represents a set of program documents with common features, about which the organization wants to gather and preserve information. The features which are common to the group of specifications, such as, title, identifying number, date of release, revision letter, etc. are its **attributes. [See Figure B-3]**

Figure B-2. Representation of an Entity

- **Attribute -** Characteristic of an entity representing information about an entity that is maintained. Attributes are shown inside the entity's box on the diagram.
  - » **Key attributes**, shown above the horizontal line, uniquely identify a specific instance (single occurrence) of the entity (for example, a given specification among all specifications in a file).
    - – **(K)** indicates the **primary key** attribute of an entity
      [The **(K)** is shown in entity tables, but not on diagrams.)
    - – **(FK)** indicates an inherited attribute called a **foreign key**
    - – **(AK)** indicates an **alternate key**, i.e. another key that may be used to uniquely identify an entity instance.
    - – Only the **primary keys (keys)** are used for **migration [See Figure B-4. Relationships]**
  - » **Non-key attributes,** shown below the line, represent additional information associated with the entity
  - » For clarity the **key attributes** and **inherited non-key attributes** are shown for a given box. The **entity tables** document all attributes associated with a particular entity.
- **Attribute Name** is a unique **singular**, **lower-case** nouns or compound (hyphenated) noun phrase
  - » Naming convention defined in DoD 8320.1-M-1, Data Element Standardization Procedures
    Attribute names in the entity boxes are abbreviated descriptions. **[See Figure B-5, Relationships - Role Naming]**
- **Attribute Examples** - Some attributes of the entity SPECIFICATION are: specification identifier, title and revision letter.

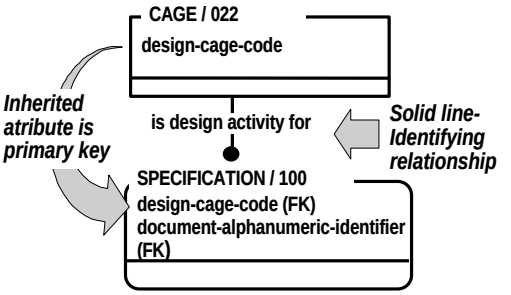
Figure B-3. Representation of an Attribute

- **Relationship** - A **business rule** describing how entities interrelate in the performance of organizational activity. A data model in MIL-STD-2549 (the graphic diagrams and related table descriptions) constitute an IDEF1x model at the fully-attributed level in which. precise business rules are defined by the relationships between entities:
  - » Relationships are depicted as **connecting lines** between entities
  - » The entities and their relationships can be read as sentences. The verb or verb phrase written on or near the line states the **business rule** for the relationship
  - » The connecting relationships at these levels are termed as **specific.** Non-specific (many-to-many) relationships are not allowed. **[See Associative entity relationships, below.]**

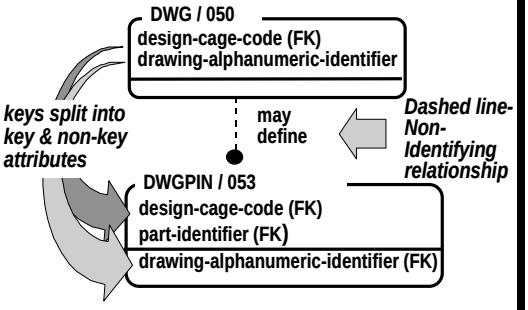


- **Relationship Examples** -
  - » A SPECIFICATION **may define** a PART
  - » A PART **may be defined by** a DRAWING
  - » Each CAGE **may be the design activity for zero, one or many** SPECIFICATIONS

- **Relationship Types -** The relationship lines indicate the type of identity relationship between the entities and the connection (migration-inheritance rules) between keys of the entities. A **Relationship line** between two entities may be solid or dashed, and has a solid ball at the terminal end.
  - » Relationships are read toward the **solid ball**
    - – In all MIL-STD-2549 relationships the **solid ball** is the **child** end
    - – Each child must have at least one **parent**, except in an optional non-identifying relationship
  - » A **solid line** represents an **identifying relationship**.
    - – The **child's keys** (set of identifying attributes) include the key attributes of the parent as foreign keys, i.e., the parent's keys are **migrated** to the child.



  - » A **dashed line** represents a **non-identifying relationship**:
    - – The child entity is existent-dependent on the parent entity, but is identifier-independent
    - – All the foreign keys inherited from the parent are **non-key attributes** of the child, or the parent's keys migrated to the child are split into key and non-key attribute



  - » A diamond symbol (✧) at the parent end of a dashed connecting relationship line identifies an **optional non-identifying relationship**:
    - – The child is existence-independent of the parent; an instance of the child may occur without a related instance of the parent
    - – The parent's keys may be inherited as non-key attributes

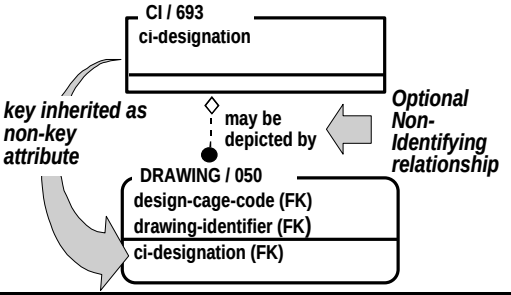
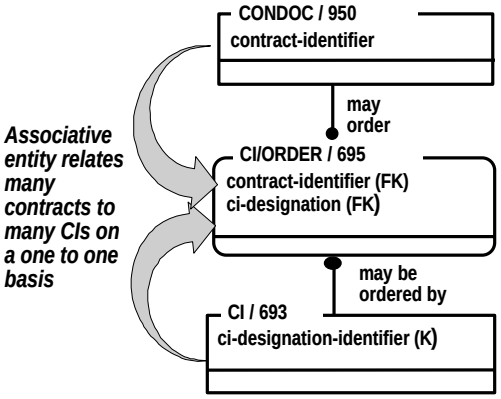


Figure B-4. Entity Relationships, Page 1 of 2

- **Relationship Cardinality** - indicates the number of instances or entries that a child entity may have in relation to its parent entity, as follows:

Notation	Number of instances
	Zero, one or many
P	One or many (P for positive)
Z	Zero or one
N	Exactly N, where N is positive
N-M	A range, where: N is a zero or positive integer M is positive

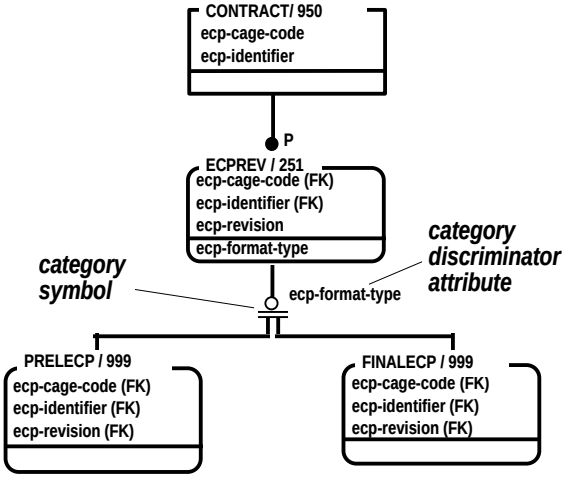


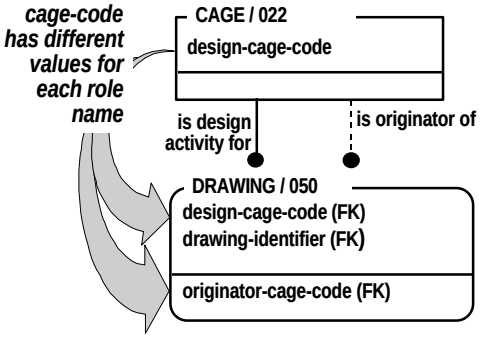
- **Associative Entity Relationships -** "Many-to-many" relationships are resolved by **associative entities** which make it possible to identify each instance of an entity.

- **Entity Categories Relationships -** Categories are used when the same kinds of information are kept about an item, but some things differ depending on status, type, or some other feature.
  - » The **category symbol** is a circle with one or two lines under it.
    - – **Two lines** indicates that all of the possible categories have been listed.
    - – **One line** indicates that there may be other categories, but they are not all listed
  - » A **category discriminator** is an attribute that distinguishes one category entity from another.
    - – It is always an attribute or an ancestor of the item being categorized (generic entity)
    - – It may, or may not, be a key attribute
  - » The relationship is always read from the generic entity to the categories entities

    If there is a single line in the category symbol there are more categories than are shown. Read as "may be either...or," as in "The ECP at a revision may be either a preliminary or a final ECP."

    If there is a double line, all possible categories are shown. Read as "is either...or," as in "The ECP at a revision





- **Role Naming** - When a relationship exists that causes a key to be migrated more than once into the same entity, the inherited attributes are given **role names** in the child entity to avoid confusion. Role names may also be used with single occurrences or a combination of inherited attributes to be more precise or place the attribute in the proper context.

Figure B-5. Entity Relationships, Page 2 of 2

The end result of applying the techniques described previously is a set of relational tables that contain the logical definition of a database and the business rules associated with the data. The relational tables describe the logical relationship of data elements for the database (i.e., the what) not the physically implemented database (i.e., the how).

Example: **Table 051, Engineering Drawing Revision Definition (DWGREV).**

table description and rules

This table is the history of the various revisions to an engineering drawing or associated list. It is one subtype of Table CAGE-NUM-DOCREV/023 for the same case as the instances in Table CAGE-NUM-DOC/022, which is a de facto parent. This table also contains characteristics about the drawing, such as total sheets and sheet size.

a. If the separate-parts-list-document-code (SEPCOD051) has a value of 'S' or 'I', then the administrative-control-drawing-document-type-code (CONTYP051) must have a value of 'N'.

b. Because this table is a de facto child of Table 050, document-source-enterprise-defense-logistics--assigned identification-code (SRCCAG022) inherited from Table 023 is really a design-enterprise-defense-logistics--assigned identification-code (DESCAG050) existing in Table 050. Therefore, SRCCAG020 assumes the identity DESCAG050.

c. Attribute document-generic-revision-identifier (DOCREV011) inherited from Table 023 assumes the role document-alphanumeric-revision-identifier (DOCREV051)

d. Because this table is a de facto child of Table 050, document-alphanumeric-identifier (DOCNUM020) inherited from Table 023 is really a engineering-drawing-document-alphanumeric-identifier (DWGNUM050) existing in Table 050. Therefore DOCNUM020 assumes the identity DWGNUM050

data element code ***data element dictionary index number***

CODE	DATA ELEMENT TITLE	DED	KEY
DESCAG050	design-enterprise-defense-logistics--assigned-identification-code	0001	FK
DOCREV051	document-alphanumeric-revision-identifier	0009	FK
DOCTYP010	document-type-code	0004	FK
DWGNUM050	engineering-drawing-document-alphanumeric-identifier	0003	FK

key attributes

non-key attributes

CONTYP051	administrative-control-drawing-document-type-code	0032	M[1]
DWGSHT051	document-sheet-total-quantity	0110	
DWGSIZ051	document-sheet-size-code	0112	
FRSTRT051	materiel-item-first-article-test-code	0077	
SEPCOD051	separate-parts-list-document-code	0025	

[1]a non-key attribute is mandatory

Figure B-6. Entity Tables

All the entities and attributes used in the data model and the characteristics about each attribute necessary to unambiguously define and describe it are included in the Data Element Dictionary (DED), Appendix C of MIL-STD-2549.

Example: Data Element Definition - CAGE Code Identifier.

data element definition (DED) reference number

DED name (corresponds to attribute name in table)

DED	**DED TITLE** or **ROLE TITLE** **Definition and Legal Values (if any)**	**Type**	**Jst**	**Dec**	**Size**
0001	enterprise-defense-logistics--assigned-identifier-code	C	F		5

data element field form (See Note 1 below)

definition

The standard code which represents and/or denotes a commercial or government entity or enterprise that manufactures and/or controls the design of items supplied to a Government Agency. United States and Canadian entities are designated by a commercial and government entity (CAGE) code while North Atlantic Treaty Organizations (NATO) are designated by a NATO Supply Code for Manufacturing (NASCM). Codes are listed in the Defense Logistics Agency Handbook H4/H8. This code has formerly been known as the Code Identification (Code Ident) and the Federal Supply Code for Manufacturers (FSCM). Must be digits or uppercase letters excluding the letters I and O (source of requirements: DLA Handbook H4/H8.) This DED is used in the following Tables: 003, 007

cross reference to where the DED is used

This DED is used as part of the following DED string(s):

DED	TITLE
0245	modification-kit-product-identifier

role name & definition (one of many)

assembled-product-design-enterprise-defense-logistics--assigned-identification-code

The CAGE which denotes the design activity responsible for the design of an assembly. This DED is used in the following table(s): 236, 239, 293, 369.

Notes:

1. FIELD FORMAT

Type

- **B** = bit-map
- **C** = any ASCII characters
- **D** = date
- **FLPT** = floating point real number (3.25E-5, $5.3x10^{12}$)
- **FXPT** = Fixed point number (1.3, -2.59, 0.003, etc.)
- **I** = integer (1, 2, 3, -5)
- **S** = string of separately defined fields concatenated in indicated order

Justification (Jst) **L** = Left, **R** = Right, **F**= Full - those which occupy entire field

Decimal placement (Dec) Number of characters to the right of the assumed decimal point

Size Number of character positions, if length is variable, maximum is shown

Figure B-7. Data Element Dictionary

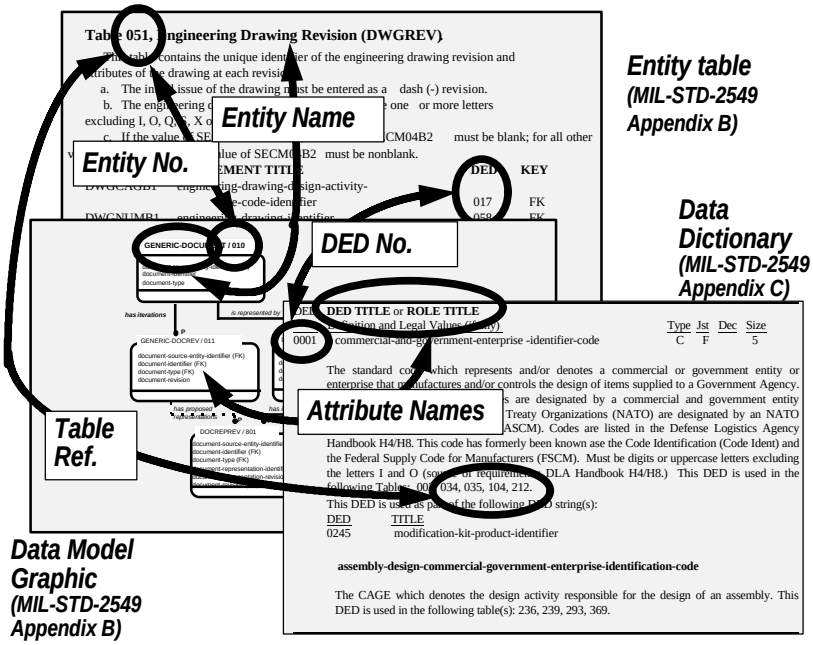


Figure B-8. Relationship of the Model Components

B.2.3 Suggested Approach to Reading CSA Model Diagrams

Each diagram represents a view of one subset of the data model. At first glance some of the diagrams in MIL-STD-2549, Appendix B may seem overly complex. This complexity is brought about by the multiple relationships that exist in the Configuration Management data itself and the various existing business rules related to this data. However, familiarity with the basic principles given in prior sections and use of the guidelines below are intended to reduce this complexity. The steps given below are suggested in reading the model diagrams.

1. Review the diagram as a whole to gain a familiarity with the topic being covered; scan it to gain a familiarity with the subject but avoid trying to understand it all-at-once. The title of the diagram indicates its subject area and the table description delineates what the table represents.

2. Look for the central entity table(s) of the diagram and determine groupings of related tables that connect (are related) to the central table(s). In many instances the table numbers and titles may be used to help establish groupings. For example, note that all of the tables directly related to a program unique specification are labeled by a number in the range "100 - 149". In most cases, the first numbered entity table in the series is the central table for the entity under consideration.

3. Select one of the groups and proceed from the central table to each related table. Refer to the table descriptions to resolve abbreviations used in the diagrams and to determine the detailed contents represented by the table boxes.

B.3 Tailoring MIL-STD-2549 Information Packets

The primary purpose of MIL-STD-2549 is to standardize CM data elements and relationships so that eventually CM systems, regardless of their operating systems, input/output design, type of computer data base, or location, will have a common basis for exchanging CM information. To accomplish that purpose, the standard provides a data model (Appendix B of MIL-STD-2549) and data element dictionary (Appendix C of MIL-STD-2549). It also provides the means for defining the CM information that must be acquired to populate a CM data base. With cancellation of MIL-STD-973, MIL-STD-2549 will be the only DoD source document for CM data requirements. The data acquisition components of MIL-STD-2549 are Data Information Packets which follow Section 6, Appendix A which provides tailoring guidance, and associated data item descriptions which are listed in Section 6.

MIL-STD-2549 is designed to enable the Government tasking activity to order CM information from either contractors or other government performing activities. The data requirements associated with MIL-STD-2549 constitute the total set of information that would be needed to fully populate every field in a total fully utilized CM data base constructed in accordance with its conceptual schema. They also encompass the aggregate information needs for all phases of a program life cycle. Obviously all of this data is not invoked for a single contract or tasking directive, only a carefully selected sub-set is applicable.

The forward and scope of MIL-STD-2549 clearly state that the standard cannot be invoked on contract as a whole and that if it is cited as a requirement in a contract, without tailoring, the requirement is not binding. MIL-STD-2549 is not intended to be directly referenced in a contract or tasking directive. The only way that it is to be invoked is through the data requirements of the contract.

This section contains supplementary information considered too detailed and explanatory to be contained in the MIL-STD. It describes the methodology and gives guidance on how to select appropriate data items to put on contract or in a tasking directive. This action is an important part of the CM planning process. **[See Section 2 and Appendix A]** The elements involved in the process and their use are described in **Table B-1**, and illustrated in **Figures B-9, 10 and 11**.

Table B-1. Elements in Tailoring MIL-STD-2549

Tailoring Element	Where Located	Purpose/Use
❶ Table A-I	Appendix A	Provides guidance on types of data to select for ordering Purpose is to limit CM data across the program life cycle so that data is only ordered when applicable. Since there is variability or overlap in the functions that are performed in the various 5000.2R phases, selection considerations are keyed to the table's design maturity line which reflects the type of activity performed. The selection criteria are categorized by, non-reparability or reparability, and then whether the acquisition is performance or design based. In each column, for each item of data listed, the selection guidance is blank (normally not required), E (essential), R (Recommended) or O (optional). For simplicity recurring data /revisions which may occur later in the life cycle are not shown but are implied. Table A-I provides a Para. Ref. to Item ❷
❷ Tailoring Para.	Appendix A, Para. 4.2 through 4.8	Provide selection and tailoring guidance for each data type listed in Table A-I. These paragraphs provide further definition of the data type and amplify its purpose and use. They also provide tailoring guidance and include to Items ❸ and ❹
❸ Tailoring Tables	Appendix A, Para. 4.2-4.8, Tables A-II through A-XIV	Provide a decision process for arriving at the specific references and language to specify in the SOW or tasking directive, and Contract Data Requirements List (CDRL). The decision criteria vary by type of data but generally are related to whether originals or copies are required, delivery or access is desired, electronic data interchange is to be acquired, whether the acquisition is internal

Table B-1. Elements in Tailoring MIL-STD-2549

Tailoring Element	Where Located	Purpose/Use
		to the military component or external (acquired by contract). At the exit end (right column) of each table are references to Item ❹
❹ Tailoring Notes	Appendix A, Para. 4.2 - 4.8, in sub-para. "Tailoring"	These alphabetized notes provide recommended language to be specified in the Statement of Work (SOW) or Tasking Directive as well as the specific DID ❺ and DIP/Sub-Packets ❻ to be invoked.
❺ Data Item Descriptions (DIDs)	Referenced in Section 6	Six DIDs are referred to in MIL-STD-2549. These DIDS refer to an associated DIP, and list the sub-packets that are included in the DIP. ❻
❻ Data Information Packets (DIPs)	DIPs 1 - 10 (In MIL-STD-2549 between Section 6 and Appendix A)	The data information packets are tables that provide: • The data elements (fields) for selected data types and sequence of data element transmittal❼, • The labels (tags) ❽ to precede each data element in the transaction string, and • References to specific instructions regarding the field content.❾ The packets are organized into sub-packets, each of which is represented as a column (1A, 1B, etc.). The sub-packets in a given packet represent data that share common data elements. **Note:** DIPs 8 through 10 represent requirements that apply to all or most data and are invoked automatically as part of the fields referenced from the other DIPs. DIPs 8 through 10 do not have corresponding DIDs.
❼ Sequence and Data Field Names	Each DIP	Common names for the data elements are used wherever possible. A given field applies to each sub-packet as indicated by the Blank, M (Mandatory) or O (Optional) listed in the sub- packet column. The sequence numbers provide the order of transmittal; fields that do not apply to the specific sub-packet are omitted from the transaction.
❽ Field Labels	Each DIP	Each data element in the transmittal stream is preceded by a tag that identifies the location for the data element in the model. Placing the data in that field will populate the parent and child relationships of that entity as well. The tag consists of a table number (Appendix B entity table) and element identifier. Where there are variables depending upon sub-packet or other parameters, further references to footnotes, to the DIP table and to content instructions ❾ are given.
❾ Data Field Content Instructions	References in the DIP Table Right hand column.	These instructions are provided to clarify the content of the fields, for example, which Table.element applies for a given sub-packet, which Table.element applies in a given circumstance, which fields are repeated as a set when there is more than one instance of a data element, etc. References are made to paragraphs within the DIP, to entity tables in the data model (Appendix B), and to specific DEDs in the data element dictionary (Appendix C), as required to discriminate or determine acceptable values.

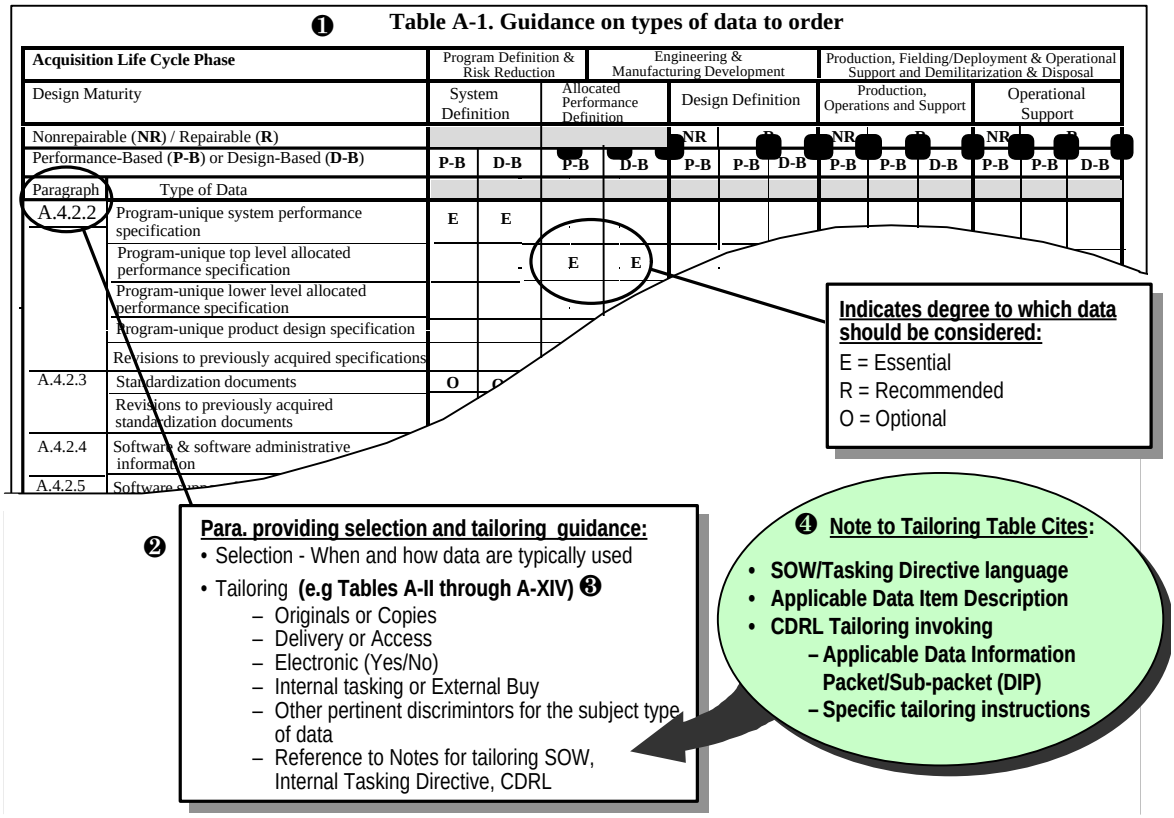


Figure B-9. Selection and Tailoring of CM Information Using MIL-STD-2549 Appendix A

A.4.2.2.2. ❷ **Tailoring.** Program-unique specifications are typically obtained via DIDs such as DI-SDMP-81493 and/or DI-IPSC-81431, -81433, -61434, and -81441 (or DI-CMAN-81551 if no other appropriate DID exists) in the CDRL. Decide (1) if the Government wants to buy the originals (including all rights to change those originals) or copies [4] (with or without the right to review/adopt changes to those originals). (2) if the program-unique specifications are to be delivered to the Government repository, or if perpetual access is to be provided by the performing activity, and (3) whether or not to buy electronuic CM data about the program-unique specifications.[5] **See Table A-III** for tailoring guidance.

❸

Table A-III. Guidance on tailoring requirements for program-unique specifications.

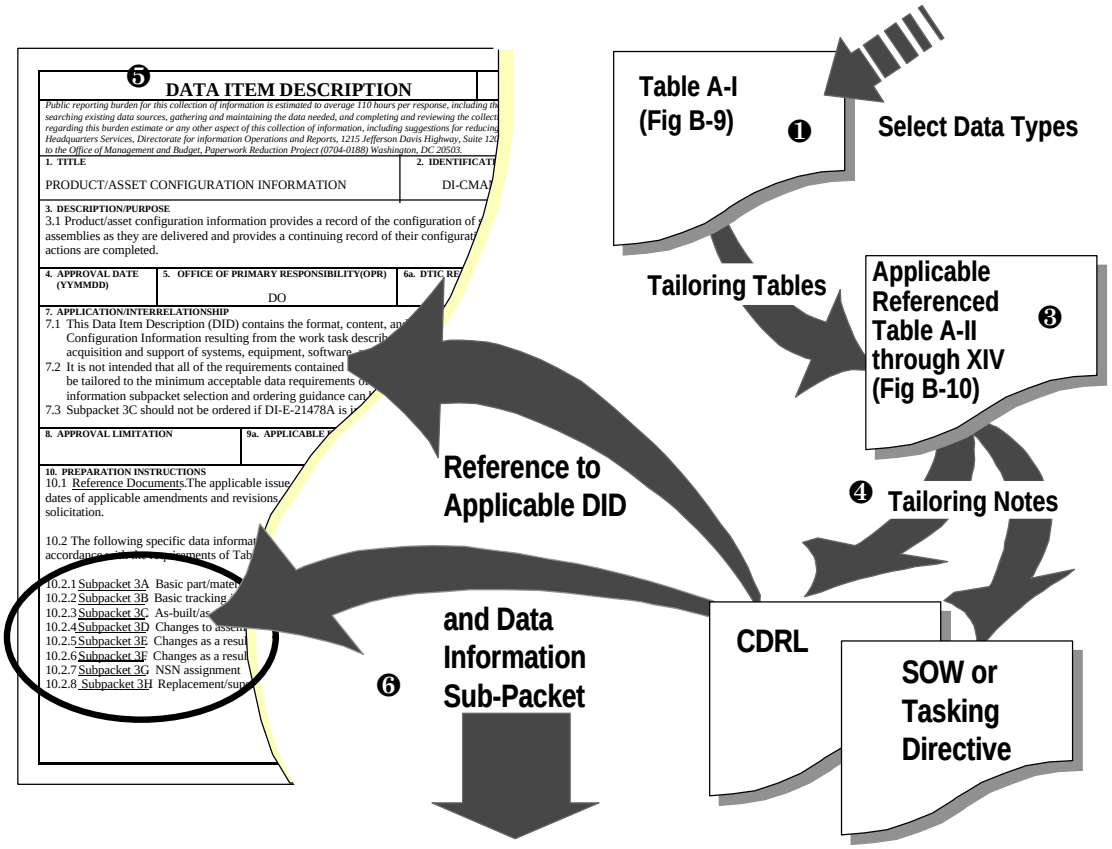
Purchase Originals or Copies	Delivery or Access	Purchase electronic CM Data	Internal Tasking or External Buy	See Notes
Originals	Delivery	Yes	Internal	a., c., and f.
			External	a., c., and g.
		No	External	
	Access	Yes	Ex...	
		No		
Copies	Delivery			

Example

❹

g. Cite the standardization document DID Number (or DI-CMAN-81551 if no other appropriate DID exists) in the CDRL and attach the completed TDP Option Selection Work Sheet for Specifications (if applicable) to the CDRL. In the remarks section of the CDRL, specify delivery of the documents according to MIL-STD-1840.

Figure B-10. Tailoring Paragraph and Table Examples Illustrating DID References



❻ TABLE DIP3-I. Product/Asset Data Information Packet

Seq #	Field Name ❼	Information Packet Number 3A	3B	3C	3D	3G	3H	Data Element Label Table.Element ❽	For content instructions, see ❾
5	Part/material name	M						200.MATNAM200 or **210.MATNAM209**[4]	Appendix C, DED 0191 and DED 0113
6	NSN	O						200.NSNNUM345 or 210.NSNNUM345[4]	Appendix C, DED 0049
7	Product-tracking base-source-code	O[5]	M	M	M			500.TRKSCD500	Appendix C, DED 0103
8	Product-t	O[5]	M					053.DOCNUM020 and 053.DOCTYP010, or 104.DOCNUM020 and 104.DOCTYP010, or 106.DOC103, or 106.TDOC421, or 106.DOCNUM020 and	DIP3.2.1.c and Appendix C, DED 0056[6]

Sub-packet: Read down column for required Fields

Sequence of Data Fields

Footnote to ❽ Table

❾ References to Entity Tables and Data Element Dictionary

[4] Use the Tag that starts with 210 for items identified by part numb... Tagthat starts with 200 for items not identified by part number.

[5] The'product tracking-base source code' (sequence 7) and ...tracking base-identifier' (sequence 8) are paired fields; either both must be blank, or both must be non-blank.

Examples

❾ Reference to paragraph providing field content instructions

c. Enter the product-tracking base-identifier which is the basis for the assignment of unique tracking identifiers. The order of preference for the product-tracking base-identifier is (1) the type and model portion of the configuration item designation (See Appendix B, Table B-II), (2) the drawing number of a tabulated part or assembly drawing, (3) thedrawing number of one of the non-tabulated parts (or assemblies) within a group of like items, (4) the specification number of parts or materials defined by a program-unique specification or standardization document, (5) the part number of a standard part, or (6) the material identifier of any material defined in terms like class, grade, type, etc., without a part number.

Figure B-11. Invoking and Tailoring Data Information Packets

APPENDIX C
CM GUIDANCE FOR INTEGRATION OF HIGH INTENSITY COMMERCIAL-OFF-THE-SHELF PRODUCTS

	QUESTIONS THIS APPENDIX WILL ANSWER	Para.
1.	What makes the integration of COTS products into a weapon system different from integration of items designed and produced for the military?	C2, C.2.1 through C.2.5
2.	What are the CM issues in COTS supplier selection and purchasing?	C.2.2
3.	What is the appropriate documentation to use to order and control COTS products?	C.2.3.1
4.	What is technical refreshment and how can it be enhanced by configuration control of COTS products at the appropriate level?	C.2.3.2
5.	How can an integrator deal with inconsistent COT product identification practices?	C2.3.3
6.	How should the integrating Government activity and/or integrating Contractor protect against product discontinuance? Obsolete spares?	C.2.4
7.	How can COTS information be integrated into the integrator's status accounting system?	
8.	What considerations are applicable to COTS software?	C.2.5

C.1 Scope.

This section relates the significant configuration management factors to consider in the acquisition and use of COTS throughout the program life cycle.. It reflects some experience and lessons learned from past programs that were COTS and NDI intensive, i.e., they were primarily an integration of “commercial-off-the-shelf” and military components that were suitable without further development. It describes unique factors to be taken into account from a configuration management point of view and provides some activity guides to use as assistance in making appropriate decisions.

C.2 Principles and Concepts

Among the goals of DoD acquisition reform is the broadening of the industrial base by using performance based acquisition, and the use of commercial-off-the-shelf (COTS) products wherever possible. In addition to the avoidance of new development cost, use of COTS products and acceptance of commercial methods is expected to result in cost savings to the Government. COTS equipment and software are normally designed and manufactured to “best commercial practices” and because they are competition and marketplace driven are often state-of-the-art designs. It is well known that cutting edge technology in many areas such as software, electronics, and especially information technology has an increasing shorter half-life. Using COTS thus enables the DoD to apply or “refresh” the technology in its weapon systems. Buying to Performance specifications, as delineated in Section 2, enables newer technology to be inserted without modifying the basic acquisition documents. This is extremely important when dealing in a commercial marketplace where contractor support of products that they have made obsolete by introducing advanced technology is short lived.

Thus the appropriate use of COTS can accomplish important goals while decreasing both schedule and cost risk. However to experience the benefits, the Government system integrator needs an awareness of the differences between military and commercial acquisition and the potential pitfalls that must be avoided.

C.2.1 Standards.

Unlike the military acquisition environment, in which the imposition of military standards (e.g., MIL-STD-973) created a more or less level CM playing field, the Integrator (Government or integrating contractor) cannot rely upon commercial

vendors having CM maturity. Commercial vendors do not have a CM standard levied upon them and industry standards are voluntary compliance documents. EIA Standard 649 which articulates CM principles and best practices is relatively new. It provides a benchmark for COTS providers to use, but each enterprise will employ those practices that it perceives to be in its own financial interests. Some have well-defined configuration management processes, while others have what may best be described as ad hoc processes.

The integrator who is concerned primarily with performance and interfaces among a set of COTS products must be able to accommodate the inconsistency in COTS provider CM practice. While less data is required in a non-developmental situation such as the acquisition of COTS, there are more complexities introduced into the integrator's process regarding such issues as the identification, operation and servicing, replacement and discontinuance of COTS items and obsolescence of their spare parts.

C.2.2 Source Selection

Configuration management can become a COTS source selection discriminator if a vendor's practices, or lack thereof, are perceived to be an impediment to effective logistic support. CM issues need to be addressed in the vendor and product selection processes. Market analysis surveys in preparation for acquiring COTS items should include CM related questions to give the integrator's CM organization insight into the vendors configuration management practices and an understanding of such vendor practices as serial and part number marking schemes. **[Detail: Table C-1. Activity Guide: COTS Vendor CM Questionnaire]**

C.2.3 Configuration Identification

COTS issues related to configuration identification include the choice of acquisition documentation, the baseline for configuration control, and how COTS products are identified and marked.

C.2.3.1 Acquisition Documentation

The use of COTS matches the acquisition reform environment when performance documentation used by the integrator to specify and manage form, fit, function and interface requirements (F^3I). Table 3-3 in section 3 of this handbook defines and provides the order of precedence for specification documents to be used for acquisition. Those documents which are performance documents are clearly indicated.

The choice of the most appropriate documentation to use for acquisition of a COTS item varies according to the product end use, supportability requirements, system complexity and many other factors. The specific documentation to use for various types of COTS products can only be determined by understanding the system complexity and the criticality of the COTS product to the program. One method of making this determination is by constructing a decision matrix **[Detail: Activity Guide: Table 3-3].**
Typically the integrator prepares a Commercial Item Descriptions (CIDs) which defines the acquisition performance requirement by F^3I (Form, Fit, Function, Interface) and copies vendor data sheet information into a Vendor Item Descriptions (VID) or Source Control Documents (SCD).

COTS products are generally developed by third party vendors. Documentation of COTS products is unregulated; therefore, its availability, consistency , and information content may be inconsistent and unpredictable. Data rights are generally not available for use in product design and modification. Additional data required for COTS should be limited to that which is normally provided to commercial buyers. Such data typically includes operating instructions, basic maintenance instructions and parts replacement, which if performed by the user will not invalidate the product warranty. Any additional data can be expensive and is generally unnecessary. Bringing commercial design documentation up to government standard levels, as was often done in the past is a cost that must be avoided. Much of such data can be quickly out-of-date or obsolete. So long as the item meets the verifiable performance requirements, and is supportable in the field using an inventory of spare parts designated by the COTS supplier, the design details should be left to the supplier.

C.2.3.2 Performance Baseline

In a performance based acquisition, the Government or its integrating contractor must specify and control to an item's performance rather than to design details. Therefore the only documentation that should be baselined by the integrator should be the performance specification or equivalent document used for acquisition. The COTS contractor may establish design and product baselines for his own convenience. Controlling at the Performance and interface (or interchangeability) level allows the COTS contractor to make changes necessary for technical refreshment and to avoid obsolescence. The contractor may make strategic market driven improvements in his product at the component level, refreshing the technology by substituting improved or later state-of-the-art components without impact to the end user's requirements.

C.2.3.3 Item Identification

There is little consistency in item identification practices among COTS producers, and often little consistency between two products provided by the same supplier. Vendor supplied part numbers may be of little value beyond the ordering stage; part numbers may be obsolete even before the product. Many vendors do not consistently mark their parts, and some do not mark the parts at all.

This, obviously, makes receiving inspection much more difficult. Because of the dynamic nature of the products, multi-site, multi-unit, and multi-year deliveries are more difficult because each individual installation may contain different revision levels of multiple products, and serialization methods often violate the basic principles of non-duplication **[Details: Section 3: 3.6.3, Activity Guide Table 3-11.]** Software licenses, upgrade tapes, and configuration files are difficult to manage because of this lack of consistency between vendors. If sparing is to be done by other than the COTS supplier, it can be a complex issue.

Nonetheless, the integrator can effectively deal with these problems if the enterprise has an effective system that follows basic CM business rules **[See C.2.5, Configuration Status Accounting]**. The integrator must be allowed the latitude to compensate for inconsistencies and poor practices by the COTS suppliers. Such remedies include auxiliary identifiers and decals applied at the time of incoming inspection for inventory control, serialization, configuration control and accounting.

C.2.4 Configuration Control.

When managing COTS items, performance specifications (performance baseline) are the key point of control. In fact, they are the only legitimate basis for configuration control that the integrator can use. As pointed out in C.2.3.2, the integrator does not have rights to the design data of a COTS supplier, and cannot direct changes to it. In the terminology used in MIL-STD-2549, the integrator is an application activity **[Ref: 4.1.1.1]** with respect to the suppliers product and its documentation, i.e., the integrator may request the supplier to make a change to its product, but does not have the right to direct that change if the supplier is not in agreement. Selection of a COTS item is based in part on life cycle cost considerations; the integrator should be cautious about obviating the cost benefit by attempting to over-control the supplier. The integrator also can choose not to use the suppliers product.

The supplier on the other hand has complete configuration control over the COTS product. The supplier may offer changes (improvements, added features) that are optional at extra cost at any time. On the other hand the supplier may make configuration changes to the product for competitive reasons without any knowledge or compliance by the integrator. COTS suppliers are also subject to unannounced changes by their own suppliers, which may in turn result in changes to the COTS product design. These supplier initiated changes, often improve the product, but are not always made with appropriate modification of technical data or in concert with programmed change activity of the ultimate end user.

Considering the nature of the respective end items, the suppliers standard practices and the competitive environment, requirements for configuration control will vary somewhat from supplier to supplier.

Wherever possible, integrator to COTS supplier configuration control requirements should include the following as a minimum:

- Advance notification of design changes that may impact the performance baseline
- Advance notification of pending obsolescence
- Advance notification of changes to field repairable/replaceable assemblies and spare parts

The integrator can be the recipient of short term notice of component and sub-component part obsolescence/changes, and is forced into a reactive mode. Without direct control of the product evolution, the integrator must compensate by being aware of pending changes as early as possible and performing change impact analyses that assess alternate solutions to determine what action is in the best interests of the Government.

The impact to the integrator and the Government is minimized by anticipating the likely level of change activity that will occur, including redesign efforts to the prime system to compensate for unplanned COTS iterations. The integrator and the Government must take these "marketplace" considerations into account when planning for and funding COTS projects. Budget reserves for these types of contingencies should be maintained.

The Government must recognize that the "long-lead" change decision and funding process typical of military weapon system programs in the past can seriously erode the savings anticipated from use of COTS. One benefit of controlling the integrator via a performance rather than a detail specification, is the ability for the integrator to react swiftly to implement the compensating changes that do not impact the performance of the prime item.

C.2.5 Configuration Status Accounting

Obviously, given the many variables discussed in the previous paragraphs, the integrator's configuration status accounting process is the place where the reconciliation between inconsistent COTS supplier CM practices and the clear accountability that is due the Government must take place. Here too there are some pitfalls to be avoided.

Many integrator's current Configuration Status Accounting Systems (CSA) will require modification or enhancement to accommodate the management of COTS products. Most current CSA systems are designed around military standard guidelines. As pointed out in C.2.3, Commercial vendors do not follow the military identification rules in identifying their products. Typically, COTS product and document identifiers often exceed the character size, allowable characters and other format restrictions rigidly enforced via edit checks in CSA systems created for earlier military contracts. Similarly revision identifiers and serial numbers can contain special characters, and exceed the field lengths for many of these legacy CSA systems.

Fortunately, today's information technology provides the means to circumvent most if not all of these inconsistencies. Through the use of relational and object oriented data base tools, bridges can be built between the "legacy" and the reality. An ancillary COTS part identifier can be assigned to the COTS part to establish an alias for the item that can be accommodated within the legacy databases. The integrator-assigned identifier (alias) for the COTS part also can be used to achieve supply support stability by building an interchangeable alternate part data base as the COTS item changes as a result of product/vendor discontinuance and upward compatible vendor changes.

C.2.6 Software Control

Special consideration should be given to the types of product baselines that need to be established and maintained on COTS software integration projects.

- COTS contractor needs to establish and maintain a software product baseline that provides integrity for the contractual developmental effort
- A unique baseline for each installation should be established to account for the hardware and software environment differences created by the use of multiple revision levels of COTS products at each installation location.

Contractors need to focus on tracking the versions of COTS tools as they apply to user-developed applications. To manage the relationship between COTS tools and developed applications:

- Maintain a meta-file in a software version-control tool identifying all pertinent COTS utilities, operating systems, and compiler version information
- Store the files making up the applicable COTS tool, utility or compiler as part of the developmental product within the contractor software version-control system or in a related PDM system.

C.3 COTS Activity Guides.

Activity Guide: Table C-1. COTS Supplier CM Market Analysis Questionnaire

1. Do you have a viable engineering drawing and part numbering system? Explain.
2. What is your method of re-identifying parts when changes are made? How do you relate part number changes to the serial numbers of the deliverable item?
3. How do you manage item modifications?
4. How do you inform your own personnel and customers of changes to your product?
5. Do you currently operate using all or any portions of any recognized CM standard?
6. Do you employ a formal change review process? Do you operate a change control board? A Material Review Board?
7. How do you assure the currency, integrity, and consistency of:
    - Material Specifications
    - Drawings
    - Indentured Lists
    - Parts Lists
    - Service Manuals
    - Operating Manuals
8. Do you have a release procedure for documentation? Explain.
9. Do you apply serial numbers and or lot numbers to your products? How are they assigned and marked?
10. By what methods do you assure that products delivered to your customers comply with the customer's order and specification?
11. What type of communication relative to change activity do you have with your suppliers?
12. Do you ever install refurbished components in your products?
13. If a product line is dropped, when is a customer notified? What options are offered the customer?
14. If a component that is supplied to the customer as a spare part is being changed, how and when is the customer notified?
15. How do you support your products? What options are typically available to the customer?

Activity Guide: Table C-2. Example Selection Matrix To Choose The Appropriate COTS Acquisition Document

Acquisition documentation types are determined based on various combinations of COTS product complexity and criticality.

Product Characteristics[1]		**Applicable Acquisition Document Type**[2]	
Complexity	**Criticality**	**COTS**	**Modified COTS**
Non-Complex	Non-Critical	• Vendor's Data Sheets	• Internal Data Sheets
Non-Complex	Critical	• Performance. Specification • Vendor Data Sheets	• Modified Performance Specification • Vendor Data Sheets
Complex	Non-Critical	• Specification. Control Drawings	• Altered Item Drawing
Complex	Critical	• Performance. Specification • Specification. Control Drawing	• Performance Specification. • Make Altered Item Drawings.

[1] Specific definitions of the item's complexity and criticality are to be defined uniquely for each end item in which COTS is to be integrated.

[2] Acquisition document types to select from, and their order of preference are listed and defined in **Table 3-3 (Section 3)**. COTS acquisition documents should be limited to those types identified as "Performance Documents"

APPENDIX D
ECP MANAGEMENT GUIDE

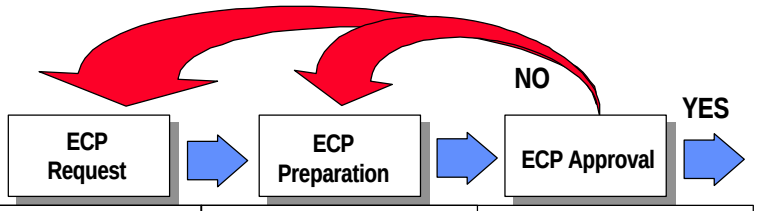
QUESTIONS THIS APPENDIX WILL ANSWER	Para.
1. Why are effective communications important to the ECP Process?	D.1, D.2
2. What are the information needs for an effective coordinated process?	D.3, Table D.1, D-2
3. What should be in a Request for ECP? An ECP?	D.3, Tables D-3, D-4
4. What can be accomplished at Coordination meeting?	D.3, Table D-5

D.1 Scope.

This guide outlines recommended communications between the Government and Contractor for the timely request, preparation and approval of ECPs. It is meant to be used by the Government Program Managers, their teams, and their counterparts in industry as an aid to minimizing the overall costs and time required for initiation and approval of formal ECPs. Use of the guide can avoid the mistakes, omissions and ECP revisions that are frequently experienced when the expectations, needs and plans of both the Government and Contractor are poorly coordinated. **NOTE:** *When using this guide, particularly in a competitive environment, it is essential that the procurement contracting officer (PCO) be the lead participant when making first contact with the contractor(s) to ensure that neither the letter nor the spirit of the Federal Acquisition Regulations (FAR) or Defense Federal Acquisition Regulations (DFAR) are violated. It is also necessary that the PCO be kept informed as issues develop.*

D.2 Principles and Concepts

Effective communication for a task requires that each party precisely understand what the other party (or parties) expect to accomplish as an end objective. Expectations of all parties are seldom the same. **Figure D-1** lists typical expectations of both the Government and Contractor for each of the three steps involved in obtaining and approving an ECP.**[Details: Section 4, Figs. 4-1 through 4-4]**



	ECP Request	ECP Preparation	ECP Approval
Value Added:	Requirement Refined Official Request Established Guidance issued for KTR KTR Understands Reqmt	SOW Generated Contractor Sched Estab. Price Quote Estab.	Proposal Inspected $'s allocated Schedule update/refined Ordering Directions Issued
Government Expectations:	Create: Adequate Guidance Clear Guidance Get: HQ Staff concurrence Issue: Timely ECP Request	Get Approvable ECP - Compliant - Tech/Logistics needs met - Compatible Schedule - Executable $-wise Timely Submittal No surprises !!!	Perform Sound ECP Evaluation Create Quality Directions - Comply w/Policy - Executable $-wise - Complete/Accurate/Clear - Realistic Impl Schedule Approve in Timely manner
Contractor Expectations:	Get: Fully Defined Requirement Understandable Requirement Achievable Requirement Special Instructions, If Any Realistic Submit Schedule Advance Notice/Coord'n Few Subsequent Revisions	Create: Sound Price Realistic Schedule Satisfy Tech/Logistic Needs Suffer Few Revisions -In-Process - After Submit Suffer Few Rejects	Get Useful Directions -Comply w/Policy -Executable $-wise -Meets Requirement -Realistic Impl Schedule -Complete and Accurate

Figure D-1. Government and Contractor Expectations in a Well-Managed ECP Process

ECP development requires close coordination between Government and contractor processes. ECP cycle times and rework have been dramatically reduced where an Integrated Data Environment (IDE), Government/contractor Integrated Process Teams (IPTs) and Single Process Initiatives (SPI) have been employed. For maximum effectiveness, IPT meetings should be well planned, highly structured and held frequently enough to ensure exchange of useful information. Use of video teleconference (VTC) facilities or on-line review and approval through automated ECP software, vice personnel travel, are encouraged whenever possible to maximize attendance and minimize costs. Such measures can reduce both the time and costs required for ECP preparation and approval.

D.3 ECP Management Activity Guides.

Activity guides (**Tables D-1 and D-2**) list the communication necessary to ensure that the Government and contractor expectations of the previous section are satisfied in an efficient and effective manner. **Table D-1** relates to the three portions of the ECP processing cycle. The time (duration such as "four month before....") cited in **Table D-1** are approximate; they are provided as examples only. Appropriate time spans for a given product or commodity type will vary considerably based on the nature and complexity of the product and the program.

Table D-2 outlines a meeting. between the Government and contractor. Suggested attendees, an agenda and a check list are provided to assist in carrying out the meeting.

Check lists are provided in

- **Table D-3, Checklist A** to assist in preparing written request for ECPs**,**
- **Table D-4, Checklist B** to assist in preparing fully compliant ECPs**,** and
- **Table D-5, Checklist C** to assist in preparing for a coordination meeting..

Activity Guide: Table D-1. ECP Coordination and Communication *at a Glance*

ECP Request Phase	ECP Preparation Phase	ECP Approval Phase
Four Months Prior to ECP Request *Government informally advise contractor of:* • General description of desired change - Function - Purpose - Any anticipated: ✓Key PRF Spec changes ✓Key warranty changes • Desired: - ECP Submit Date - Forward Fit Effectivity - Retrofit Effectivity - Delivery Schedule • Planned Installer • Anticipated Level of Install • Program/Cost-Profile Constraints • Any Unusual: - Spares Requirements - Data Requirements (New or Revised) - Training System Requirements - Interim Support (Interim Spares, O/I/D Level Spares) • Any Plans to Furnish: - GFE/GFI - Government Facilities/Personnel • FMS/Joint-Services Requirements • Anticipated Release Date for ECP Request **Two Months Prior to ECP Request** *Government informally advise Contractor of:* • Any updates to above *Contractor informally advises Government of:* • General acceptability of planned ECP Request • Any issues with plans or ECP submittal schedule **Upon Release of ECP Request** *Government provides Contractor:* • Official ECP Request - Compliant with **Checklist A [Table D-3]** • Signed by Program Manager designated official	**Within Two Weeks After Receipt of ECP Request** *Contractor informally advises Government of:* • Receipt of Request (Start date of preparation cycle) • Estimated ECP submission date • Any noted problems or deficiencies with request **2nd Month after Receipt of ECP Request (and every 2 months)** *Contractor informally advises Government of:* • General approach being taken (Draft SOW) • General preparation status of SOW, Pricing, Vendor Interface, Other • List of Acquisition Logistics items being addressed: - LSAs/Maintenance Plan - Tech Manuals: ✓Operator ✓Maintenance ✓Trainers - Interim Support ✓Interim Spares ✓O/I/D Level Spares - Spares/Repair Parts/SML - Training - Trainers & Support for Trainers - Support Equipment / Software ✓Development ✓Production ✓Logistics ✓Spare/Repair Parts - Packaging, Handling, Shipping • Intended Data deliverables • Need for Govt. Facilities, Personnel, GFE or GFI **Within 3 Working Days After Discovery of Problem** • *Govt. PM* informally advise Contractor of any Reqmt. change • *Contractor PM* informally advise Govt. of significant deficiency/issue **Upon Release of ECP Request** *Contractor provides Government:* • Official ECP Request - Compliant with **Checklist B [Table D-4]**	**Within One Month After Receipt of ECP** *Government informally advises Contractor and DCMC of:* • Receipt of ECP • Status of Decision memo • Availability of Funding **Monthly** *Government informally advise Contractor and DCMC of:* • ECP Decision memo Status • ECP Approval Status - Engineering - Acquisition Logistics - Other • Estimated CCB Approval Date • Availability of Funding • Anticipated Contractual Authorization Date *Contractor advise Government of:* • Any change in validity of submitted (active) ECPs

Activity Guide: Table D-2. Government/Contractor ECP Coordination Meetings

A Key to Effective Communication and Coordination

SCOPE

Suggested Frequency: Every Other Month (6 Times Per Year)
Suggested Medium: Video Teleconference or Face to Face

ATTENDEES: (A Typical Example)

Contractor:
- PM Reps (Type/ Model Manager; Configuration Manager)
- Program Engineering Manager
- Program Logistics Manager
- Proposal Manager
- Contracts Manager (As Required)
- Pricing Manager (As Required)

Government:
- PM CM Manager
- PM Business/Financial Manager
- Engineering Manager (Cognizant Engineer)
- Logistic Manager (AMPL)
- Assist. Program Manager for Training Systems (APMTS)
- PCO
- ACO
- FMS/Joint-Services Rep
- Inventory Control Point (ICP) Rep
- Supply Support/Spare Manager
- GFE Manager

AGENDA

1 Review Forthcoming Requests for ECPs.
2. Review the Status of All ECPs in Preparation.
3. Review the Status of ECP Approval Actions and Funding Issues.
4. Review Need/Status for Detail Working Meetings.

OTHER

Support System for Assigning/Tracking Subsequent Actions

.

Activity Guide: Table D-3. Check List A - Request for an ECP Readiness for Release (For Sole Source Class I ECPs)

Item	Check ✓ if Adequately Addressed
General Description Of Desired Change	
Function	
Purpose	
Any Anticipated: Key Performance/Spec Changes	
Key Warranty Changes	
Interchangeability/Replaceability Issues	
Reliability & Maintainability/Life Cycle Cost Impact	
Desired: RFP Date	
ECP Submit Date	
Effectivity - Forward Fit	
Effectivity - Retrofit	
Delivery Schedule (Government Desired)	
Trainers/Training	
Support Equipment	
Logistics/Spares Support	
Packaging, Handling, Storage And Transportability (PHST)	
Shipping Containers	
Planned Installer	
Anticipated Level Of Install	
Program Constraints - (Scheduling Impacts.etc.)	
Any Unusual: Logistic/Spares Requirements	
Data Requirements (CDRLs)	
Vendor	
Interim Support	
Interim Spares	
O/I/D Level Spares	
Any Plans To Furnish: GFE/ GFI	
Government Facilities/Personnel	
Commonality And Interoperability	
FMS/Joint-Services Requirements	
Possible Tailoring Of Mil-Std Requirements	
Testing/Qualification Requirements (Fatigue,Etc.	
Manufacturing Requirements (Tooling, Etc.)	
Cost/No Cost (If Cost: Type, Desired Effectivity Of Pricing, i.e.,180 Day)	

Activity Guide: Table D-4. Check List B - ECP Readiness for Submittal

Item	Check ✓ if Required		If Yes, Check ✓ if Provided		
	Yes	No	Description	Schedule	Cost
Engineering Design, Development & tests					
Nature of Change (Safety, etc.)					
Design					
Analyses					
Drawings (Production/Retrofit)					
Qualification					
Automatic Test Procedure & Equip					
R&M Analyses/Test					
Flight Test					
Trial Kit Install					
Other Testing/Field Evaluation					
Spec Changes: Weight			*		
Service Life			*		
Performance			*		
Interchangeability/ Replaceability			*		
Obsolescence			*		
Other			*		
Data Deliverables (CDRLS)					
Bailed/GFE Aircraft or other Equipment					
Other Equipments Affected (GFE Design, Second Source, Trainers.Etc)					
Tooling					
GFE/GFI					
Prod Incorporation (Recurring)					
Effectivity					
FMS					
Logistics Support (New & Retrofit)					
LSA/Maintenance Plan					
Support Material List					
Repair Parts					
Provisioning/(Design Change Notices)					
Tech Manuals					
Operator					
Maintenance					
Trainers					
Interim Support					
Interim Spares					
I/O/D Level Spares					
New Spares					
Training					
Trainers					
Support for Trainers					
Support Equipment: SERD					

* Provide Specification Change Detail (Was/Is or Revision Annotation) in ECP

Activity Guide: Table D-4. Check List B - ECP Readiness for Submittal

Item	Check ✓ if Required		If Yes, Check ✓ if Provided		
	Yes	No	Description	Schedule	Cost
Nonrecurring Engineering					
Recurring (Prod/Retro)					
ILS (Training, LSA, CETS)					
Spares					
Repair Parts					
Technical Directive					
Validation/Verification					
Packing, Handling, Storage and Transportability					
Shipping Containers					
Government Facilities/Personnel					
Retrofit:					
Tech Directive					
Validation					
Verification					
Kits for Basic Equipment					
MOD for Basic Equipment (Install)			#		
Kits for Maintenance Trainers					
MOD of Maintenance Trainers (Install)			#		
Kits for OPS Trainers					
MOD of OPS Trainers (Install)			#		
Kits for Spares					
MOD of Spares			#		
Other:					
Impact on Ozone Depleting Substances					
Environmental Considerations					
Additional Impacts Not Specifically Covered Above					

Effectivity, Maintenance Level & Location

Activity Guide: Table D-5. Check List C - ECP Management Meetings

Item	Check ✓ if Adequately Addressed
1. Review Forthcoming RFPs	
a. Identify all Requests for ECPs to be issued within 4 Months	
b. For each ECP	
• Anticipated Release Date for ECP Request	
• Review **Check List A** for each New ECP Request	
c. Update above information, if previously provided	
2. Review the Status of All ECPs in Preparation	
Contractor	
a. For each ECP Request received since last meeting informally advise Government of	
• Receipt date	
• Estimated date of ECP Submission	
• Any noted problems/deficiencies with request	
b. For each ECP in-work, informally advise Government of:	
• Progress in completing **Checklist B**	
c. Advise Government of any changes to information previously provided or any special term and/or conditions not previously identified	
Government	
a. Informally advise Contractor of any changes (i.e., funding or requirements) which may impact previously issued requests for ECPs	

APPENDIX E
SAMPLE CONFIGURATION AUDIT CERTIFICATIONS

QUESTIONS THIS APPENDIX WILL ANSWER	Para.
1. What is the appropriate information to be included in a configuration audit certification package?	E.2

E.1 Scope.

This appendix supplements Section 6. It provides illustrative examples of configuration audit certifications.

E.2 Sample Certifications

A Configuration Audit Certification Package is part of the Configuration audit report. Figure E-1 illustrates the composition of a typical audit certification package. Table E-1 provides examples of Audit certification Checklist content including assertions and other information for common FCA and PCA certification topics.

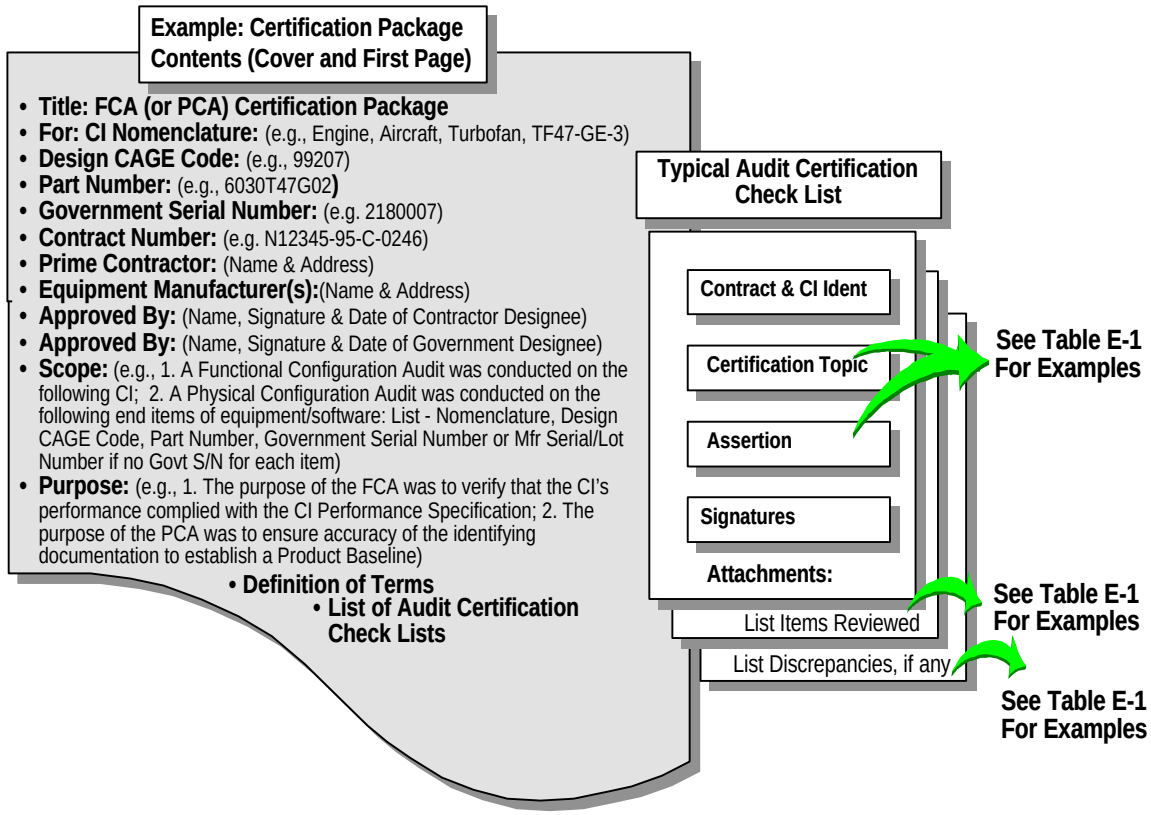


Figure E-1. Contents of a Typical Configuration Audit Certification Package

Table E-1. Audit Certification Checklist Contents

Checklist Topic	Content
Functional Configuration Audit (FCA)	
1. Verification test procedures and results	• **Assertion:** The verification procedures and results have been reviewed to assure that the approved procedures were followed, that the reports are accurate and completely document the CI verifications, and that the design meets the CI performance and system specification requirements. • **Check:** □ Verification procedures and results satisfy the specification requirements and are accepted. See attached comments □ Verification procedures and results are unacceptable. See attached discrepancies • **Signatures:** » FCA Sub-Team Members » FCA Sub-Team Chairperson • **Attachments:** » List of Documentation reviewed – CI Nomenclature – Specification No. – Associated Verification Procedure No. – Verifications reviewed: • Spec. Para./Verif. Para. • Verification Description • Results » Comments to documentation » Deficiency List – Action item identifier – Report Reference – Description of Discrepancy – Responsibility for correction – Place of Inspection – Inspected By
2. Examination of Drawings for On-Order Parts (Applicable for FCA of Hardware CI in accordance with Detail Specification)	• **Assertion:** The drawings and related lists documenting the exact design of those parts which are already on order due to long-lead and initial spare parts provisioning actions have been examined • **Check:** □ The documented design matches the ordered design or the order has been changed to require the delivery of the final FCA design See attached comments □ See attached discrepancies • **Signatures:** » FCA Sub-Team Members » FCA Sub-Team Chairperson • **Attachments:** » List of Documentation reviewed – Drawing Number – Title – Revision – Date of Revision – Order Status (e.g., Updated, On-Schedule) » Comments to documentation » List of Discrepancies (See Deficiency List in item 1. above)

Table E-1. Audit Certification Checklist Contents

Checklist Topic	Content
Physical Configuration Audit (PCA)	
1. Specification Review and validation	• **Assertion:** The Product baseline Specification(s) for the CI has been reviewed and validated to assure that it adequately defines the configuration item(s) and the necessary testing, mobility/transportability, and packaging requirements for the production of the CI. • **Check:** □ The Product Baseline Specification(s) is complete and adequately defines the CI. See attached comments □ The Product Baseline Specification(s) are unacceptable. See attached discrepancies • **Signatures:** » FCA Sub-Team Members » FCA Sub-Team Chairperson • **Attachments:** » Hardware Product Baseline – Equipment Nomenclature – Spec Identifier – Date of Issue – Top Assembly Dwg. identifier – Dwg. Rev. » Software Product Baseline – Software Nomenclature – Spec Identifier & Date of Issue – Version Description Document No. & Date of Issue » Comments to Documentation » List of Discrepancies (See Deficiency List in FCA item 1. above)
2. Drawing Review	• **Assertion:** The drawings have been compared with the equipment to ensure that the latest drawing change letter has been incorporated into the equipment, that part numbers agree with the drawings, and that the drawings are complete and accurately describe the equipment.. See attached indentured listing of all drawings reviewed • **Check:** □ The drawings are complete and accurately describe the equipment. See attached comments □ See attached discrepancies • **Signatures:** » FCA Sub-Team Members » FCA Sub-Team Chairperson • **Attachments:** » List of Drawings reviewed by the Team (Indentured) – Drawing Identification (CAGE, Drawing Number Dwg. Rev., Date of Issue & Title » Comments to Documentation » Drawing Review Discrepancies (See Deficiency List in FCA item 1. above) – Drawing Identification (See above) – Part Number Identification (Part No. CAGE, SN/Lot No., etc.) – Nature of Discrepancy (Drawing and Equipment did not match)
3. Review of Software Code/Listings (and Other SW Documentation)	• **Assertion:** The deliverable software has been compared to the listing of deliverables contained in the Version Description Document. All required changes have been incorporated into both the specification and the deliverable software and the listing in the specification exactly matches the software being delivered.

Table E-1. Audit Certification Checklist Contents

Checklist Topic	Content
	• **Check:** □ The software listings are complete and accurately reflect the digital information contained on the deliverable software medium. See attached comments □ See attached discrepancies • **Signatures:** » FCA Sub-Team Members » FCA Sub-Team Chairperson • **Attachments:** » Listings and design documents reviewed by the team – Software Identification (CAGE, Identifier, Media Identifier) – Document Identification (CAGE, Document Number, Rev., Date of Issue & Title) – Nature of Discrepancy » Comments to documentation
4. Acceptance test Procedures and Results	• **Assertion:** The acceptance test procedures have been reviewed for adequacy and the acceptance test results have been reviewed to ensure that the testing has been properly done and certified. • **Check:** □ The acceptance test procedures and results satisfy the specification requirements and are accepted. See attached comments □ The acceptance test procedures and results are unacceptable. See attached discrepancies • **Signatures:** » FCA Sub-Team Members » FCA Sub-Team Chairperson • **Attachments:** » List of Acceptance test procedures reviewed – CI Nomenclature – ATP Document Identification (CAGE, Document Number, Rev., Date of Issue & Title) – Status » List of Acceptance test results reviewed – CI Nomenclature – Document Identification (CAGE, Document Number, Rev., Date of Issue & Title) – Status
5. Version Description Document	• **Assertion:** The deliverable software listing and related documentation has been compared to the listing of deliverables contained in the VDD to ensure that all documentation required for use of the software is correctly identified in the VDD. • **Check:** □ The VDD is complete and accurately reflects the documentation required to operate and support the software See attached comments □ See attached discrepancies • **Signatures:** » FCA Sub-Team Members » FCA Sub-Team Chairperson • **Attachments:** » VDD Review Results – Software Identification (CAGE, Identifier, Version Identifier) – VDD Document Identification (CAGE, VDD Document or file identifier,

Table E-1. Audit Certification Checklist Contents

Checklist Topic	Content
	Rev/version, Date of Issue & Title) – Nature of Discrepancy » Comments
6. Software Media	• **Assertion:** The medium to be used for delivery of the software has been evaluated to ensure that it matches the requirements specified in the contract and that an executable image of the software can be created in the host computer using the medium. • **Check:** □ The software medium matches the contract requirements and is useable for the purposes intended. See attached comments □ See attached discrepancies • **Signatures:** » FCA Sub-Team Members » FCA Sub-Team Chairperson • **Attachments:** » Software Media Review Results – Software Identification (CAGE, Identifier, Version Identifier) – Software media Identification, Date of version/Issue & Title/subject) – Nature of Discrepancy » Comments
7. Software Manuals	• **Assertion:** The final draft manuals generated for loading, operating, and supporting the CSCI have been reviewed to ensure that they reflect the most current changes made to the software • **Check:** □ The manuals are complete and accurately match the current version of the software. See attached comments □ See attached discrepancies • **Signatures:** » FCA Sub-Team Members » FCA Sub-Team Chairperson • **Attachments:** » Manual review results - Listing of manuals reviewed by the team – Software Identification (CAGE, Identifier, Media Identifier) – Document Identification (CAGE, Document Number, Rev., Date of Issue & Title) – Nature of Discrepancy » Comments to documentation
8. Examination of Inspection/Receiving Documents (e.g., DD-250)	• **Assertion:** The PCA article(s) has been examined to ensure that it adequately defines the hardware/software and that all shortages, un-incorporated changes, and other deficiencies are covered by an approved Request for Deviation. • **Check:** □ The material inspection/receiving document(s) adequately defines the hardware/software. All shortages, and un-incorporated changes and other deficiencies such as un-accomplished tasks are covered by approved deviation request. □ See attached discrepancies • **Signatures:** » FCA Sub-Team Members

Table E-1. Audit Certification Checklist Contents

Checklist Topic	Content
	» FCA Sub-Team Chairperson • **Attachments:** » Listing of Parts/Software identified as shortages – Part/SW Identifier – Requirement Document – Affected Requirement – Status » Listing of Un-incorporated design changes – Change Identifier – Requirement Document – Affected Requirement – Status » Listing of Deviations pertaining to the PCA article – Deviation Identifier – Specification & Requirement affected – Approval status/date
9. Program Parts Selection List	• **Assertion:** The parts being used in the hardware design as listed on the drawing parts lists and as installed in the PCA article have been compared to the applicable program parts selection list (PPSL) to ensure that only approved parts are being used • **Check:** □ The CI contains only approved parts listed on the applicable PPSL See attached comments □ See attached discrepancies • **Signatures:** » FCA Sub-Team Members » FCA Sub-Team Chairperson • **Attachments:** » Listing of PPSL, drawings and hardware items reviewed by the Team – PPSL Identifier and date – Document Identification (CAGE, Document Number, Rev., Date of Issue & Title) – Items/Parts inspected – Nature of discrepancy » Comments
10. Contractor's Engineering release and change Control System	• **Assertion:** The contractor's engineering release system and change control procedures have been reviewed to ensure that they are adequate to properly control the processing and formal release of engineering changes. • **Check:** □The contractor's engineering release system and change control procedures are adequate for processing and formal release of engineering changes. See attached comments □ See attached discrepancies • **Signatures:** » FCA Sub-Team Members » FCA Sub-Team Chairperson • **Attachments:** » List of Discrepancies » Comments

APPENDIX F
CM STANDARDS
COMPARISON MATRIX

QUESTIONS THIS APPENDIX WILL ANSWER?	Para.
1. Where are the generally equivalent requirements found in the various CM Standards? What are the differences in coverage and treatment of related subjects?	F-2

F.1 Scope.

Using EIA Standard 649 as the baseline, similar paragraphs and topics in the following documents are compared. MIL-STD-973 is included to provide a reference point for legacy programs.:

- EIA-649, "National Consensus Standard for Configuration management"
- MIL-STD-2549, "Configuration Management Data Interface"
- IS0-10303-203, "Application Protocol: Configuration Controlled Design"
- IS0 10007, "Quality Management -- Guidelines for Configuration Management"
- IEEE STD 828-1990, "Software Configuration Management Plans"
- MIL-STD-973, "Configuration Management" (REF)

F.2 Comparison Matrix.

The comparison matrix is provided in **Table F-1**. A direct comparison of Standard 649 to Standard 2549 is not possible since 649 is a “what” (what are the components of a good CM Program) and 2549 is a tailorable “how” (how to capture status accounting information in a “one face to Government” format). Standard 2549 supports all of the necessary CSA elements and relationships to satisfy the “whats” addressed in Standard 649. A check mark in Table F-1 means there ia a corresponding topic area in the comparison document.

Table F-1. Comparison Matrix - CM Standards

649 Para.	Title and Principle(s)	2549	203	10007	828	973
5.1	**Configuration Management Planning and Management**. Plan CM processes for the context and environment in which they are to be performed and manage in accordance with the planning: assign responsibilities; train personnel; measure performance; and assess measurements/trends to effect process improvements.			√ 4.2.2 6.2 7.2.1 7.7	√	√ 4.2
5.1.1	**Identifying Context and Environment**. To determine the specific CM value adding functions and levels of emphasis for a particular product, identify the context and environment in which CM is to be implemented.	√ 6.3		√ 6.1 6.2 7.7	√	√ 4.2
5.1.2	**Configuration Management Plan**. A configuration management plan describes how configuration management is accomplished and how consistency between the product definition, the product's configuration, and the configuration management records is achieved and maintained throughout the applicable phases of the product's life cycle.	√		√ 4.2.3 7.7 Annex A	√ 2.	√ 4.2f 5.2.1
5.1.3	**Implementation Procedures.** Prepare procedures to define how each configuration management process will be accomplished.			√ 4.2.3 7.2, 7.4 7.5, 7.6	√	√ 4.2f 5.2.1
5.1.4	**Training**. Conduct training so that all responsible individuals understand their roles and responsibilities and the procedures for implementing configuration management processes.			√ 6.2		
5.1.5	**Performance Measurement**. Assess the effectiveness of CM plan implementation and performance of the configuration management discipline with defined metrics (performance indicators).	√ 4.5		√ 4.2.4 8		√ 5.5.7
5.1.6	**Supplier Configuration Management**. Performing configuration management includes responsibility for the configuration management performance of subordinate activities (e.g. subcontractors and vendors).	√ DIP6		√ 6.2	√ 2.3.6	√ 5.6.1.1
5.2	**Configuration Identification**. Configuration identification is the basis from which the configuration of products are defined and verified; products and documents are labeled; changes are managed; and accountability is maintained.	√		√ 5.2	√ 2.3.1	√ 4.4 5.3.1 5.3.5
5.2.1	**Product Information**. Configuration documentation defines the functional, performance, and physical attributes of a product. Other product information is derived from configuration documentation.	√	√	√ 7.2.2	√	√ 5.3.1 5.3.4.1 5.3.4.2
5.2.2	**Product Structure**. The product composition (i.e. relationship and quantity of parts that comprise the product) is determinable from its configuration documentation.	√	√	√ 5.2.1 7.2.1	√	√ 5.3.1 5.3.2
5.2.3	**Product Identifiers**. All products are assigned unique identifiers so that one product can be distinguished from other products; one configuration of a product can be distinguished from another; the source of a product can be determined; and the correct product information can be retrieved.	√ DIP3		√ 5.2.3 7.2.3	√	√ 5.3.6 5.3.6.1 5.3.6.2 5.3.6.4 5.3.6.5 5.3.6.7

Table F-1. Comparison Matrix - CM Standards

649 Para.	Title and Principle(s)	2549	203	10007	828	973
5.2.3.1	**Identifying Individual Units of a Product**. Individual units of a product are assigned a unique product unit identifier when there is a need to distinguish one unit of the product from another unit of the product. **Identifying Individual Units of a Product**. When a product is modified, it retains its original product unit identifier even though its part identifying number is altered to reflect a new configuration.	√ 4.2.2.2	√	√ A.3		√ 5.3.6.6
5.2.3.2	**Identifying Groups of Units of a Product**. A series of like units of a product is assigned a unique product group identifier when it is unnecessary or impracticable to identify individual units but nonetheless necessary to correlate units to a process, date, event, or test.	√	√		√	√ 5.3.6.6
5.2.4	**Document Identification**. All documents reflecting product performance, functional, or physical requirements and other product information are uniquely identified so that they can be correctly associated with the applicable configuration of the product.	√ 4.2.5		√ 5.2.3 7.2.3	√	√ 5.3.6.3
5.2.5	**Baselines**. A baseline identifies an agreed-to description of the attributes of a product at a point in time and provides a known configuration to which changes are addressed.	√ DIP6		√ 5.2.4 7.2.4	√ 2.3.1.1	√ 5.3.3 5.3.4
5.2.5.1	**Establishing Baselines**. Baselines are established by agreeing to the stated definition of a product's attributes.	√		√ 5.2.4 7.2.4	√	√ 5.3.3 5.3.4 5.3.5
5.2.5.2	**Types of Baselines**. The Configuration of any product, or any document, plus the approved changes to be incorporated is the current baseline.	√		√ 5.2.4 7.2.4	√	√ 5.3.3 5.3.4
5.2.5 5.2.5.1 5.2.5.2 5.3.3	**Release system.** Maintain release control of documents for baseline management (inferred principle).	√		√ 5.3		√ 5.3.5
5.2.6	**Product Identification Recovery**. Recovery of product information may be necessary in cases where records of operational units of a product do not match the actual units (as reported by maintenance activities) or where such records do not exits.					
5.2.7	**Interface Control**. For product interfaces external to the enterprise, establish an interface agreement and a mutually agreed to documentation of common attributes.			√ 7.4.2		√ 5.3.7.
5.3	**Configuration Change Management**. Changes to a product are accomplished using a systematic, measurable change process.	√ 4.4.2 DIP4	√	√ 5.3	√ 2.3.2	√ 4.5 5.4 5.4.1 5.4.2.1

Table F-1. Comparison Matrix - CM Standards

649 Para. Title and Principle(s)		2549	203	10007	828	973
5.3.1	**Change Identification**. Each change is uniquely identified.	√ DIP4	√	√ 5.2.3 7.2.3 7.4.1	√	√ 5.4.2
5.3.1.1	**Requesting Changes**. Changes represent opportunities for improvement.	√ DIP4	√	√ 7.4.1	√ 2.3.2.1	√ 5.4.2
5.3.1.2	**Classifying Changes**. Classify requested changes to aid in determining the appropriate levels of review and approval.	√ DIP4	√	√ 5.3 7.4.1	√	√ 5.4.2.2.1 5.4.2.4
5.3.1.3	**Documenting Requests for Changes**. Change requests must be clearly documented.	√ 4.4.2.1	√	√ 5.3 7.4.1	√	√ 5.4.2.2.3 5.4.2.3.5 5.4.2.4.1
5.3.2	**Change Evaluation and Coordination**. Consider the technical, support, schedule, and cost impacts of a requested change before making a judgment as to whether the change should be approved for implementation and incorporation in the product and its documentation.	√ 4.4.2.1.1 DIP4	√	√ 5.3 6.2 7.4.2 7.4.3	√ 2.3.2.2	√ 5.4.2.1
5.3.2.1	**Change Impact Assessment**. Determine all potential effects of a change and coordinate potential impacts with the impacted areas of responsibility.	√ DIP4	√	√ 5.3 7.3 7.4.2	√	√ 5.4.2.1
5.3.2.2	**Change Effectivity Determination**. Change documentation delineates which unit(s) of the product are to be changed. Change effectivity includes both production break-in and retrofit/recall, as applicable. **Change Effectivity Determination**. A changed product should not be distributed until support and service areas are able to support it.	√ DIP4	√		√	√ D.5.1.21 D.5.1.23
5.3.2.3	**Change Cost/Price Determination**. The decision maker is aware of all cost factors in making the decision.	√ DIP4			√	√ D.5.4.2 5.4..2..2.3. 3
5.3.2.4	**Change Approval Authority**. Change approval decisions are made by an appropriate authority who can commit necessary resources to implement the change.	√ 4.4.2.1.2	√	√ 5.3 7.3 7.4.3	√ 2.3.2.3	√ 5.4.2.3.1 5.4.2.4..3- 5.4.2.4.5
5.3.3	**Change Implementation and Verification**. Implement an approved change in accordance with documented direction approved by the appropriate level of authority. **Change Implementation and Verification.** Verify implementation of a change to ensure consistency between the product, its documentation and its support elements.	√	√	√ 5.3 7.4.4	√ 2.3.2.4	√ 5.4.2.1
5.3.4	**Change Management Process applied to Variances.** If it is considered necessary to temporarily depart from specified baseline requirements, a variance is documented and authorized by the appropriate level of authority.	√		√ 5.3 7.3		√ 4.5 5.4.3- 5.4.4

Table F-1. Comparison Matrix - CM Standards

649 Para.	Title and Principle(s)	2549	203	10007	828	973
5.4	**Configuration Status Accounting**. An accurate, timely information base concerning a product and its associated product information is required throughout the product life cycle.	√ 4.4.2.3		√ 5.4 7.5.1	√ 2.3.3	√ 4.6 5.5.1
5.4.1	**CSA Information**. Configuration information, appropriate to the product, is systematically recorded, safeguarded, validated and disseminated. **CSA Information** Configuration information content evolves and is captured over the product life cycle as tasks occur.	√ √ 4.4.2.4		√ 5.4 7.5.2 7.5.3	√ √	√ 4.6 5.5.2 5.5.4 5.5.5 5.5.8
5.4.2	**CSA System**. Data collection and information processing system requirements are determined by the need for configuration information.	√ 6.3		√ 5.4 7.5.2 7.5.3	√	√ 5.5.3
5.5	**Configuration Verification and Audit**. Verification that a product's requirement attributes have been met and the product design meeting those attributes has been accurately documented is required to baseline the product configuration.			√ 5.5	√ 2.3.4	√ 4.7 5.6.1 5.6.2 5.6.3
5.5.1	**Design and Document Verification**. Verification that a design achieves its goals is accomplished by a systematic comparison of requirements with the results of tests, analyses or inspections. **Design and Document Verification**. Documentation of a product's definition must be complete and accurate enough to permit reproduction of the product without further design effort			√ 5.5 7.4.4 7.6		√ 5.6.2 5.6.3
5.5.2	**Configuration Audit**. Where necessary, verification is accomplished by configuration audit	√ 4.5 DIP5		√ 7.6		√ 5.6.1 5.6.2 5.6.3
5.5.3	**Continuing Performance Audits and Surveillance**. Periodic reviews verify continued achievement of requirements, identify and document changes in performance, and ensure consistency with documentation.	√ 4.5.1 4.5.2		√ 7.6		√ 4.7
5.6	**Configuration Management of Digital Data**. Apply configuration management principles to ensure the integrity of digital representations of product information and other data	√ DIP9		√ 7.2.3		√ 4.3
5.6.1	**Digital Data Identification**. Apply digital data identification rules to maintain document, document representation, and file version relationships.	√		√ 7.2.3		√ 4.3.2
5.6.2	**Data Status Level Management**. Apply business rules using data status levels for access, change management, and archiving of digital data documents.	√		√ 5.3		√ 4.3.2
5.6.3	**Maintenance of Data and Product Configuration Relationships**. Maintain relationships between digital data, data requirements, and the related product configuration to ensure accurate data access.	√		√ 7.2.3		√ 4.3.2
5.6.4	**Data Version Control and Management of Review, Comment, Annotation, and Disposition**. Apply disciplined version control to manage document review electronically.	√ 4.6.1 4.6.2		√ 7.2.3		√ 4.3.2

Table F-1. Comparison Matrix - CM Standards

649 Para.	Title and Principle(s)	2549	203	10007	828	973
5.6.5	**Digital Data Transmittal**. Ensure that a transmitted digital data product is usable.	√				√ 4.3.1 4.3.2 4.3.3
5.6.6	**Data Access Control**. Effective digital data access fulfills requirements, preserves rights, and provides users with data they are entitled to in the correct version.	√ 4.6.3				√ 4.3.1 4.3.2 4.3.3